Harvey Cushing

To Laurence Pickett

from Elliott Cutler

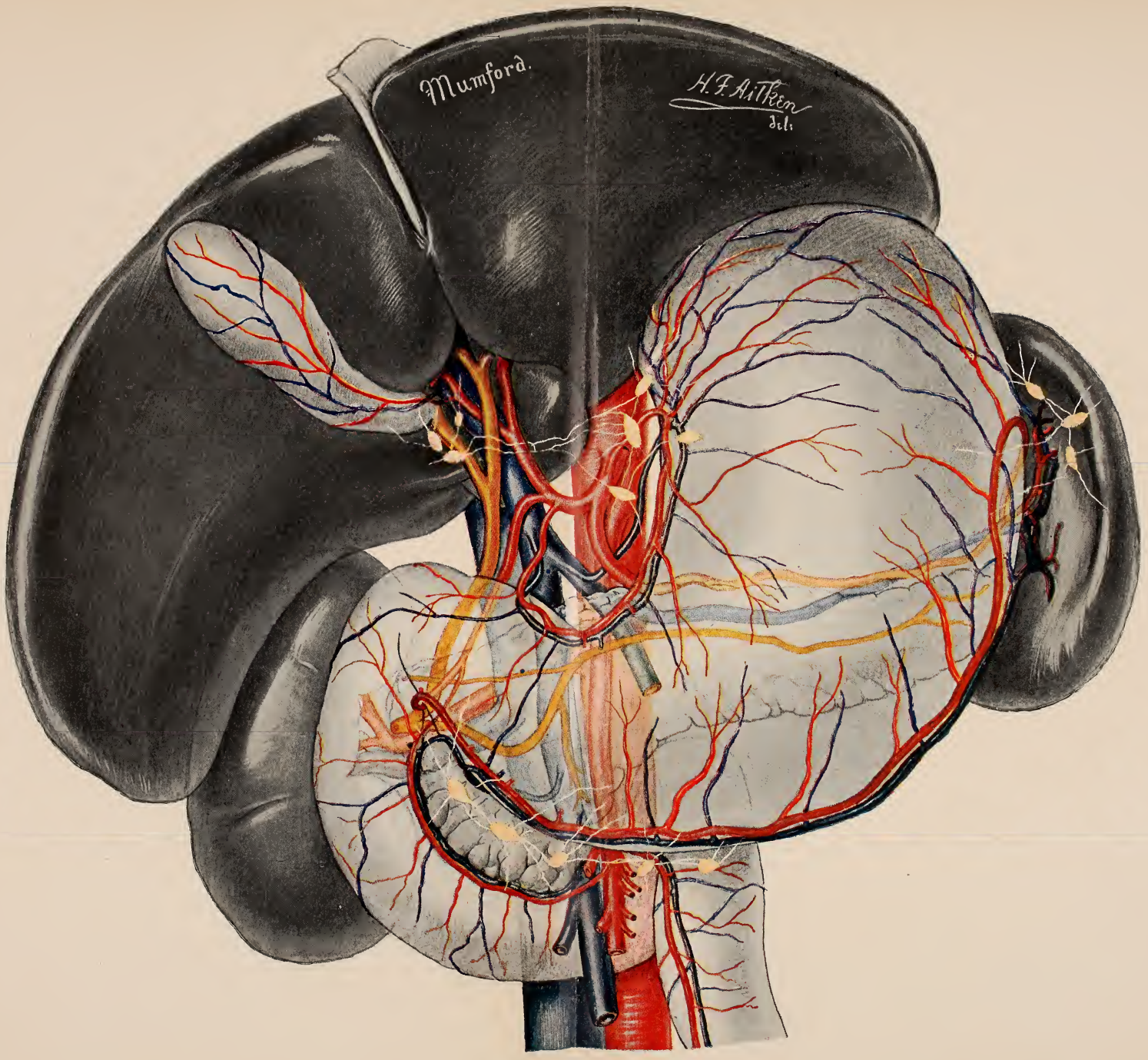
Xmas 1945

This was once my old chief's book. - Hope it will interest you.

E.C.

SURGICAL ASPECTS OF DIGESTIVE DISORDERS


The MMCo.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SURGICAL ASPECTS

OF

DIGESTIVE DISORDERS

BY

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TO

JOHN COLLINS WARREN

SURGEON SCHOLAR TEACHER

WHOSE UNTIRING ZEAL FOR THE ADVANCEMENT OF

MEDICINE

WILL BE A LASTING INSPIRATION TO HIS

PUPILS

ARGUMENT

THE purpose of this volume is an estimate of what surgery may accomplish in diseases of the abdominal digestive organs; we do not choose to consider here that part of the digestive apparatus connected with the buccal cavity, the fauces, the pharynx, and the œsophagus. In the great flood of more or less controversial writing and talking on the subject of our theme, few definite conclusions for the benefit of the general practitioner have yet been reached. Probably it is still too early for certainty, but by associating together a surgeon and an internist in the writing of this book, by examining our ascertained facts with an approach from different, but not opposing, points of view, we hope to have arrived at certain broad and justifiable *conclusions* so far as present knowledge of the subject permits.

The reader may be disappointed, perhaps, in the undogmatic character of our results; we cannot say of disease of the bile passages and of gastric ulcer what has come to be said of appendicitis, that they are purely surgical diseases, but we believe we can show that in many instances they are so, and we insist that in all prolonged or severe disorders of such nature the views of a properly qualified surgeon should be sought. In other words, such diseases have passed out of the hands of the internist acting alone. He must share with the surgeon the responsibility, and share it early.

A clear-headed surgeon has said, "If you have a patient who has suffered for two years from a chronic dyspepsia, unrelieved by internal treatment, you may fairly say that his case is probably a surgical one, and that relief may be

found from an operation upon one of five organs, — the stomach, the pancreas, the bile passages, the kidney, or the appendix."

That is doubtless too broad a generalization, but it is worth bearing in mind.

For some years we who write this have been in the habit of impressing upon our students the fact that the duodenum is the central chamber of the digestive apparatus (Fig. 1). Borelli taught something of this sort nearly three hundred years ago, and that ancient Italian master had a keen appreciation of physiological conditions.

If we look broadly at the anatomical arrangement of the parts, we see that he was right. Into the duodenum the stomach empties its contents. Bile and the pancreatic juice flow into it, the right kidney is near it, and it is continued in the intestine, which lower down finds itself encumbered with the appendix vermiformis.

All of these organs, including the duodenum itself, are subject to disease; and with it all of these organs, excepting the appendix, are closely associated. The disease of one organ may involve the disease of others,—indeed, such associated diseases are commonly found, that of the appendix included; so that a broad and philosophic view of digestive disturbances must take account of all these organs as a complex. It is a compound of many diseased organs with which we have to do. In writing one should not deal with them separately, as has usually been done; indeed, the common method of the text-books — the treating of digestive diseases upon an individualized anatomical basis — we regard as ineffective for an appreciation of this involved question.

Historically the development of knowledge of the physiology and anatomy of the digestive organs was slow. Not until modern times has such knowledge become fairly rounded; while the therapeutics of the diseases concerned was practically stationary for centuries. We shall present a short sketch of the development of these matters, an under-

standing of which is essential to a broad appreciation of the situation which is now developing in medical practice.

We shall take up the consideration of the individual organs concerned and of their diseases, bearing in mind always the close anatomical relationship of such organs with each other and the frequent interdependence of their diseases the one upon the other.

The stomach is the organ most closely connected with the duodenum, so that the stomach first shall engage our attention. Destructive inflammatory processes are far more common in it than used to be supposed. Such processes and their sequelæ lead to an infinite variety of anatomical changes, and to trains of symptoms which are too often assigned to chemical alterations in the digestive fluids. Such chemical alterations, when they exist, are frequently secondary and of secondary importance. If normal function and health are to be restored, the question of damaged mechanism first must be considered; and how this restoration may be accomplished is the central thought in our theme. The inflammatory processes in the stomach often cause inflammatory and crippling changes in other organs, the process spreading by direct continuity, so that the picture continues to alter in kaleidoscopic fashion.

That the stomach itself undergoes profound alterations, varying with the time of life and with sex, is another striking fact. The acute ulcer of young women, often spontaneously healing, presents quite another problem from the chronic, intractable ulcer of middle-aged men. The latter form of ulcer is the one especially to which surgery brings relief. The dilated weak stomach of the alcoholic may be reduced and relieved by the measures of the internist; the chronically distended stomach resulting from the cicatrized stenosis of a pyloric ulcer can be cured by surgical measures only. You must constantly, in your practice, be bearing in mind the great frequency of stomach dilatations, cicatrices, and adhesions associated with disturbances of digestion. If

you will examine carefully all your cases of "dyspepsia," you will be surprised to see how frequently the stomach tympany extends below the umbilicus, and you will do well in all such cases to remember that surgery may be your resort, not tardily and rarely, but promptly and frequently. Early operation on these stomachs is safe, easy, and effective; late operation may be dangerous, difficult, and futile.

The same statement applies to disease of the bile passages. You will find gall-stones in the ducts, associated with gastric ulcer; you will find the gall-bladder adherent to the duodenum; you will find cholangitis; you will find calculi in the gall-bladder when you least expect them; and you will find plugging of the ampulla of Vater, with consequent pancreatitis. These are, for the most part, late manifestations, which might have been avoided by early operation.

The various conditions may be single and simple, or they may be complicated; and though frequently you may with medicine remove the symptoms and enable the patient to resume his regular course of life, signs of the old trouble are apt to return again and again, until chronic invalidism is established or the patient finds relief through surgery and the unravelling of the deranged mechanism.

The constant irritation of a low grade of appendicitis, causing directly an involvement of the associated organs, and numerous dyspeptic symptoms with consequent malnutrition, adds to our problem another factor frequently unappreciated. That is a subject on which we propose to say an urgent word.

Added to all these organic disturbances, there is another and important complication only recently appreciated, but still continually disregarded, — ptoses, displacements of the various abdominal organs; displacements involving one or many or all; ptoses of the stomach, the kidneys, the liver, the intestines, and, not by any means least, of the pelvic viscera.

The field of the gynecologist may seem far removed from

the stomach, but the displaced uterus may experience an uncomfortable association with its superimposed fellow, and digestive disturbances of far-reaching significance may find their cause in combined stomach and uterine ptoses.

To the overdriven general practitioner, or the man who has never turned his attention especially to disorders of digestion, it may seem that such conditions as we have described are infrequent and are related but little to his ordinary routine. It is for precisely such physicians that we wish to point a moral. Dyspeptic conditions are common enough in your experience, though you may have accustomed yourself to think of them as transient, trifling, and easily treated.

The patient who complains of morning headache, of occasional eructations, of some palpitation, and of constipation may be the victim of gastric cicatrices and beginning pyloric stenosis.

The man who tells you that he is troubled with distress several hours after taking food and with occasional stomach-ache may be suffering from gastrectasis or gall-stones.

The child with a poor appetite, pallor, lassitude, and constipation alternating with diarrhœa may have a chronic appendicitis.

The rather frail, neurasthenic young girl or the tired mother of many children, the sufferer from dysmenorrhœa, or the elderly widow with heartburn may be affected with displacements of the stomach, the kidneys, and the uterus.

These examples are suggestions merely, but if you observe closely you will find them very true, and repeated over and over again in your daily round. That hundreds of dyspeptic symptoms are transient and may easily be treated, no man shall deny, but we must not be blinded by so simple a faith. Probably one at least out of every dozen of such cases has some definite anatomical derangement, and for such your search must be unwearied.

As illustrating what may be accomplished in diagnosis by

the careful investigation of cases, we have added, in an Appendix, the able paper of our colleague, Dr. Henry F. Hewes.

In a large sense the purpose of this book is a discussion of current problems, — problems more or less familiar to the surgeon, less so perhaps to the practitioner of general medicine. To both classes of men we address ourselves, however, and ask their consideration of the following pages.

FIG. 1. — *Supplement*; showing occasional relation of vermiform appendix with right kidney; colon cut away; retro-cæcal appendix.

CONTENTS

CHAPTER X

CHAPTER XI

CHAPTER XII

SURGICAL ASPECTS OF DIGESTIVE DISORDERS

CHAPTER I

ANCIENT CONCEPTIONS OF THE DIGESTIVE ORGANS

In glancing back over the history of therapeutics one expects to find that from the earliest times digestive disorders especially attracted the attention of medical practitioners; for of digestive disorders we are wont to think that they begin with infancy and persist through life more universally than do all other physical affections. Yet the ancients had much less solicitude for such disorders than have we. So far as one may judge from the early writings these disorders were infrequent and little regarded until later times. The reasons for this disregard or apparent immunity are obvious enough. Among primitive peoples, leading a rough, open-air life, eating a simple diet, near to nature as the phrase now runs, dyspepsia was little known. This was as true doubtless of the ancients as of those North American Indians whose bodily virtues and wholesome life our own Rush described less than a hundred and fifty years ago.[1]

So a good natural hygiene was found in the early days, and as civilization advanced, a good hygiene continually was preached. Among the Egyptians, the Jews, the Persians, the Greeks, beauty and strength of body were held the greatest good, and where nature failed, art stepped in to remedy defects. The book

[1] Benjamin Rush, "Natural History of Medicine among the Indians of North America." 1774.

of Leviticus gives us the keynote to the regulated lives of the Jews, whose practices did not differ greatly from those of their Egyptian associates. Their frequent ablutions, their abstinence, their dietary, their activity, and their scrupulous relations with women all tended to the upbuilding and preserving of clean and vigorous bodies.

Among the Persians, too, when at their best, before they were enervated with success and debauchery, the sound body was most to be desired, and, if we can believe what is written of them, their capacity for working and fighting with undiminished vigor on scanty rations and little sleep was amazing.

The Greeks of the Hippocratic era seem to have regarded permanent physical ills as not deserving the attention of serious philosophic minds. To such an extent did they carry this thought that, in the schools of the Asclepiadæ, chronic diseases are merely referred to, some are not even named, and very few are described. For chronic affections were regarded as inconveniences not meriting the attention of physicians.[1]

The important business of those old practitioners was the care of their men wounded in battle. Traumatic surgery came first, then the preservation of women in childbirth, and then the study and conduct of acute diseases. Of course there were cases of acute digestive disorders, but the treatment was not intricate. Dietetics were of most importance, then emetics were given to clear the stomach, and drastic cathartics completed the simple scheme. Vomiting

[1] P. V. Renouard, "History of Medicine."

was a recognized prophylactic. Says an author of the Hippocratic school, "He who is in the habit of vomiting himself twice a month will find more advantage in doing so on two successive days than once every two weeks." [1]

It was all very natural and uncomplicated — treatment by those ancient men. They knew little of anatomy, of physiology still less. Cleanliness was their god; they washed and polished and oiled the body for its good, and when the mysterious internal machinery went wrong they washed and cleaned and polished that, so far as in them lay.

Through all the dreary blank of the Middle Ages, such little rational medicine as existed looked back to Galen (131–201 A.D.) and contented itself with commentaries upon his writings. Now Galen's physiology, while sound in many respects, was fragmentary, though he advanced our knowledge of anatomy. With Plato and Aristotle he made the soul play an important part in the animal economy. The soul had three parts or faculties: one resided in the liver and was called the vegetative; another in the heart, the irascible; and another in the brain, the rational. And this was his view of the nutrition of the body: the food taken up from the intestines is carried to the liver and there turned into blood, for in the liver dwells the vegetative soul; and this newly created blood carries thence "natural spirits." Then this blood is borne by the vena cava to the right side of the heart, where some of it is sifted through the ventricular septum into the left side. When the

[1] *Ibid.*, p. 97.

heart contracts and expands, the blood from both sides is forced backward and forward like the flow of the tides, some of it going to the lungs whence it draws air back into the left side of the heart, where it becomes laden with "vital spirits," and thence ebbs back and forth through the rest of the system. This vitalized blood goes to the brain, among other places, and there it generates the "animal spirits," which spirits, becoming separated from the blood, are carried as pure spirits along the nerves. So these are the spirits which effect motion and carry on the various higher animal functions. The above is one illustration of Galen's physiology. It was more elaborate than that of Hippocrates, for he knew more of anatomy than did the Father of Medicine. He was somewhat more accurate, but of the functions of the digestive organs he guessed little, while his practice followed the ancient simple methods. As Hunt says, "his comments upon the writings of Archigenes upon the pulse, his doctrines of the temperaments (the sanguine, cold and warm; the phlegmatic, moist and cold; the choleric, dry and warm; the melancholic, dry and cold) and his dogma of 'contraries,' which gave origin to the 'allopathy' of those who love to think and talk dogma, did as much or more than anything else to pad what might be called medical scholasticism. Perhaps the worst to be said of him is that he assisted in preserving the health of Commodus; and the best, that he maintains much the same relative position in medicine as that occupied by Marcus Aurelius in philosophy."[1]

Then through a thousand years we see little change in

[1] David Hunt, "Talks on the History of Medicine." Boston, 1898.

the treatment of digestive disorders. Medicine progressed doubtless. At first great names appear upon the roll, — names which it is needless to recall. Customs and manners changed in some degree; wealth, luxury, and evil living increased. The lusts of the body replaced the claims of grace and beauty and strength. The physical man declined as civilization advanced and, for a long period in the degenerate Greek and later Roman days, the ills of the flesh became as complicated and as much objects of interest and solicitude as among us moderns. But no new aid was there. Something more of anatomy was learned, some further suspicion of the functions of the organs crept in; some striking advance in the art of surgery was made, but through it all and in spite of all, authority, not observation, ruled; the same old drugs were given, the same crude means were used, the same mysterious pains, and nauseas, and "heart-burns," and "fluxions," and agonies, and fatalities prevailed until far past the dawn of modern times.

We must regard Andreas Vesalius as the first of the modern masters in medicine, for he began to teach us how to study the human body, and though the *Fabrica Humani Corporis*, which appeared in 1543, deals mainly with anatomical problems, and though his physiology is largely that of Galen, he saw the value of the vivisection of animals, and in a striking chapter pointed out the advantages of that method of study. But it is as an anatomist that he deserves our gratitude, for he threw aside authority and showed that only through an accurate and thorough knowledge of the structure of the body can we hope to arrive at a knowledge of function.

After Vesalius, it is to Borelli, Malpighi, Paracelsus, Van Helmont, and Harvey that we owe more than to others of the seventeenth century, — at least so far as knowledge of function is concerned, — and they gave us some little new light on the problems of digestion. Borelli (1608–1679) was primarily a mathematician and a physicist, and he regarded his studies on the living body as providing a field in which to apply new methods of physical research.[1] A very important division of his work dealt with muscular mechanism. He devoted great attention to this and similar problems, and in remarkably correct fashion showed how some of the most important functions of the body, such as the movements of the limbs, the action of the heart, and the contraction of the blood-vessels are purely mechanical and can be investigated by the ascertained laws of mechanics. From such conclusions, which are in the main correct, it is easy to see how he leaped readily to similar conclusions regarding digestive processes, and advanced opinions concerning their more complex phenomena, in which he attempted to show that in them, too, we are still dealing with purely mechanical conditions. Some of his experiments in this direction were extremely ingenious, and may well have convinced an observer to whom chemistry was unknown. He called attention to the fact "'that in birds, with few exceptions, the crushing, erosion, and trituration of food is effected by the muscular stomach itself, compressing one part of its horny lining against another. Thus with the help of small, hard, and sharp pebbles contained in it, which serve instead of teeth,

[1] Foster's "History of Physiology," p. 67.

the stomach, by pounding the food swallowed and rubbing its inner surfaces on it this way and that, like millstones, crushes the parts of the food until they are converted into a very fine powder. . . . I introduced by the mouth into the stomach of turkeys, glass globules, or empty vesicles, and leaden cubes, similarly hollowed out, pyramids of wood, and many other things, and the next day I found the leaden masses crushed and eroded, the glass pulverized, and the remaining ingesta in the same condition.'" [1]

In spite of the apparent earnestness of such writing, it is a fact that up to, and even until after, this time, the physiology of digestion occupied men but little. As Foster says: "If you take up a text-book of modern physiology, you will find page after page occupied with chemical matters. In some text-books digestion and its consequences take up so large a space as to suggest to the reader that the stomach is the larger part of man. It is not so with the writings of Vesalius, . . . the whole of digestion and nutrition is dismissed in almost a single sentence."

The microscope was lacking to Vesalius and Borelli, for the microscope was invented about 1590. After the middle of the seventeenth century Marcello Malpighi (1628–1694) began turning it to histological uses, which in his own lifetime, through himself and some few others, advanced enormously our conception of the intricate nature of the digestive processes. It would be a pleasant task to tell the life history of this accomplished man. To most of us it is a name suggesting merely the minute anatomy of the kidney, but Malpighi

[1] *Ibid.*, p. 165.

was a laborer in many fields, all of which were left more fertile for his toil. Botanist, embryologist, naturalist, pathologist, biologist; he was all of these, but it is especially as histologist that he attracts us.

As a histologist, Malpighi explored many organs besides those concerned strictly with digestion. He was the first properly to describe the structure and function of the lungs; in some fashion he recognized the arrangement of the fibres which connect the surface of the brain with the cord, he carrying his microscopical studies into other regions; he explained the arrangement of the layers of the skin, and described the *rete mucosum*, sometimes known to us as the Malpighian layer; more important still, he ascertained the presence of those disks which we recognize as red corpuscles in the blood stream, and by his discovery of the capillaries, completed the circle which had been left partly finished by Harvey.

It is Malpighi's work on the glands, and especially the liver, that concerns us here; very important work in the study of function, it was supplemented by the anatomical discoveries of other men, his contemporaries and immediate predecessors. In 1642 John George Wirsung, professor of anatomy at Padua, had discovered and demonstrated the duct of the pancreas, which is known by his name. In 1652 Thomas Wharton of London discovered the duct of the submaxillary gland, and in 1661 Nicolas Stenson investigated and described the duct of the parotid gland. So these three glands, salient in the bearing they have upon our subject, came to be regarded no longer as isolated structures, though their function was still undetermined by Wirsung,

Wharton, and Stenson, whose observations halted with their demonstrations of the gross anatomy. In 1662 Laurentio Bellini, a youthful pupil of Borelli, saw the kidney tubules, while eight years earlier the Englishman, Francis Glisson, laboriously and elaborately had demonstrated that intricate liver capsule which bears his name.

All these observations and ascertained facts were essential for the future work of Malpighi. It was in 1666 then that he published his important book on the viscera, and he dealt with four organs, the brain, spleen, kidneys, and liver. Of the first three organs it suffices to say that with the exception of the brain, they were described in a fashion so admirable and final that for nearly a hundred and fifty years little more of importance was added to knowledge concerning them. Of the liver, however, and Malpighi's conception of its relation to digestive processes it is interesting to say some word. In the first place, he showed, what was not before appreciated, that the liver is a conglomerate secreting gland in structure, and that its elements are arranged in small clusters which he named acini. As Foster says, that was the end of the mystery of the liver. It secreted bile, just as other glands secreted their peculiar products, and the bile took its origin from the liver and not from the gall bladder, as was being erroneously asserted by some. The previous work of Glisson was an important aid to Malpighi in making his point, and he pays his respects to that eminent anatomist, more than once, in the course of his argument.

Nearly two hundred years before Malpighi there lived near Erfurt a Benedictine monk, Basil Valentine,

known widely thereafter as the first among the *Chymists*.[1] He is to be noted because he seems to have been the earliest to maintain the proposition that digestion is due to an acid-dissolving *menstruum*, and not to any mechanical action of the organs concerned. But more especially is he interesting to us because he influenced greatly the views of his famous successor Von Hohenheim, commonly known as Paracelsus. That last remarkable man precedes Malpighi by more than a hundred years; indeed, he was somewhat the senior of Vesalius, but may be numbered among his contemporaries, though in the then limited diffusion of knowledge, neither man seems ever to have influenced the work and teachings of the other. Vesalius knew of Paracelsus well enough, but thought him an impostor or a lunatic.

It is hard to say how much of anatomy was familiar to Paracelsus, but much or little, he thought poorly of it. He was an alchemist or chemist through and through; and casting to the winds the teaching of the regular schools, he preached that diseases should be known by the name of the drug which cured them, not by titles founded on anatomy or symptoms. It is needless here to enlarge upon the system of Paracelsus, — a system resting on metaphysics and distorted conceptions of the nature of physical and spiritual forces. Suffice it that he believed these forces could be controlled and directed by properly selected drugs, and so it was to the discovery and employment of these drugs that he turned all the vigor of his impetuous and errant genius. It was a wild and disorderly life with a tragic end, but

[1] Edward Barry, "A Treatise on a Consumption of the Lungs." London, 1727.

it left its impress upon the thought of the day, an impress which was to expand vigorously fifty years later into a famous school of physiology, of which Van Helmont became the corner-stone.

Paracelsus believed that behind the functional processes of organs in the human body, there was an *Archeus*, or imaginary entity, an intelligent vital principle; indeed, he thought there were numerous such entities in the body, some subordinate to others. This thought was also in the mind of Van Helmont; though with wider knowledge and deeper learning, he was not guilty of the absurdities and excesses of his forerunner. He was a man of fine mind, accurate and careful in his work, and many of his methods and observations would not be unworthy of present-day observers. But he was a mystic as well as an observer. He invented the term *Blas*, by which he meant something quite similar to *Archeus*, but he also invented the word *Gas*, and in that he showed himself the rational chemist. Chaos, gas; the similarity in sound suggested the latter word. Carbon dioxide is evidently what he meant, and his investigations into fermentative processes led him far along the lines of modern chemistry. When he comes to consider digestive processes he breaks away from the old idea of the liver with its natural spirits, the heart with its vital spirits, and the brain with its animal spirits. Be they as they may, and he denies them, he demonstrates for our benefit and for the first time that there is an *acid* ferment in the stomach. His conception of the source of this "menstruum" was definite enough. He asserts that it is prepared in the spleen and not in the stomach itself. It is from the spleen, he says, that

the stomach draws all its energy. This he says, casting aside the clear reasoning of Vesalius; and Malpighi had not yet written (1621). So he goes on to describe various stages of digestion, six in all, and all of them dependent upon some form of fermentation. There was the acid fermentation of the stomach. Then there was the digestion in the duodenum, "through a more excellent vigor of transmutation." This he states, though ignorant of the pancreatic juice. After that he describes sundry other digestions; in the liver, in the heart and arteries, and in the various tissues of the body.

Now there were three notable conceptions in the writings of Van Helmont, which mark an important advance; he showed that many of the vital processes were chemical in their nature and were not merely mechanical, as Borelli taught; he asserted that certain of the changes taking place are of the nature of fermentation, and he discovered carbonic acid gas and other gases, which years afterward came to be recognized as factors of the first importance.

The work of Franciscus Sylvius (François Dubois, 1614–1672) was an important supplement to that of Van Helmont. This Sylvius is not to be confused with that Jacobus Sylvius, of "fissure" fame, — the sixteenth-century anatomist who was the master of Vesalius.

During the era of Franciscus Sylvius, men were exercised by the discovery made by Gaspar Aselli of Cremona, in 1622, of the lacteals; by the demonstration of the thoracic duct of Van Horn in 1652, and by Olaus Rudbeck's (Upsala) exhibition of the course of some of the lymphatics. Now Sylvius was a man of much the same training and experience as Van Helmont, — a physician,

anatomist, and chemist, — but he was a clean-cut practical person, free from mysticism. The discovery of the true function of the heart and the circulation of the blood which Harvey had announced in 1628 had been ignored by Van Helmont, but Sylvius appreciated the importance of Harvey's work, and much of his teaching is founded on that appreciation. He believed in the lessons of chemistry as he saw them, he looked for no occult spiritual agencies to explain vital phenomena, but asserted that the chemistry of living things is the same as the chemistry of so-called dead things; and working at his desk with salts, acids, and bases, he concluded that the chemistry of the living body might be explained by the same laws as governed his laboratory reagents. He had other advantages over his predecessor, for he knew not only of the gastric juice and bile, but of the secretions derived from the salivary glands and the pancreas. Sylvius's explanation of the actions of these various agents in promoting "effervescence" is far from satisfactory to the modern physiologist, but he saw that they did exert a definite action which bore an important relation to the digestion and assimilation of food.

So we have seen how by the middle of the seventeenth century, through the study of physiological phenomena, two distinct lines of thought, or schools, had arisen to explain the nature of digestive processes. The two leading exponents of these thoughts were the contemporaries, Borelli and Sylvius. Borelli explained the phenomena on purely mechanical grounds, and his fellow-believers formed the iatro-physical or mechanical school; Sylvius assigned to chemical action alone the

results observed and was the leading teacher of the iatro-chemical [1] school, and there for many years the matter rested. Other teachers, indeed, arose, but their influence made for little true advance. Notably there was Stahl, of Halle (1660–1734), a very able and interesting man, who recognized the value of both Borelli's and Sylvius's contentions, but taught that granting their claims, there remained behind all a "sensitive soul" essential to both mechanical and chemical actions as exhibited in the living body. So the term "animism" arose, with Stahl as founder of that philosophy.

It is interesting to note how an English writer, Barry,[2] early in the eighteenth century sets forth for us such knowledge as he saw fit to accept in his day.

"Sylvius rav'd of his *Duumvirate*, and carried the *Colluctations* excited in the *Duodenum* from a mixture of an *acid pancreatic* juice and an *alkaline Bile* into the Blood, and endeavored to account not only for *Digestion* but for most diseases and their methods of cure, either from these *effervescencies* being too *intense* or too *languid*. These notions prevailed for a long time, and producted fatal errors, till they were at length exploded by greater Improvements in *Anatomy* and *Chymistry*." Then he goes on to assert that the *vasa brevia* in the *chylopoietic* bowels receive a humor from the stomach, but that this humor is neutral; that no acid is produced in the stomach, but that whatever acid is there is due to the fermenting remains of food. To counter-

[1] ἰατρός = a practitioner of medicine.

[2] Edward Barry, M.D., "A Treatise on a Consumption of the Lungs, with a Previous Account of Nutrition." London, 1727.

act the effect of this, Elix. Propriet. Tart.[1] was to be given, and aromatic bitters, said to contain a volatile salt of a nature opposed to acids, and therefore useful to quiet this form of indigestion and promote an appetite.

However that may be, he goes on to show that after all it is not the stomach which plays the leading part in digestion. Indeed, most of the students of the seventeenth and early part of the eighteenth century regarded the stomach as a rather subordinate organ in the digestive process. To both schools it seemed a sort of useful reservoir; for the Borelli folk it did some grinding, for the iatro-chemists, some fermenting, but the great interest for both schools lay in the intestines and in the tissues of organs. Barry says, "beside these causes already mentioned, it is probable that the chyle is impregnated in the stomach and intestines with a great Quantity of animal spirits; for there is an uncommon distribution of nerves to these parts and much greater than seems sufficient for their muscular motion."

Such in brief fashion was the state of knowledge regarding the digestive organs until we come down to the time of the famous Boerhaave (1668–1738) of Leyden, and his more famous pupil Haller (1708–1786) of Bern and Göttingen. Both of these men are figures so important in our studies that they must have passing mention; indeed, Haller's researches were so exact and convincing, with the light he had, that little more, beyond occasional speculation, was added to exact

[1] "Elixyr Proprietatis Paracelsi" is similar to our modern Tinctura Aloes et Myrrhæ.

knowledge of the subject until two generations had passed.

Boerhaave was an incessant worker, hungry for learning, a clear-headed judge of the value of existing knowledge, and a magnetic teacher of men. He was too well rounded to be led away by theories and systems, and though he added little of value through original research, he collected and expounded the best that had been done up to his time, winnowing the chaff and throwing clear light on what was salient in the science of his day. Thus he appreciated, and, with proper precautions, taught the best that he had learned from both the iatro-physicists and the iatro-chemists. He understood that the digestive apparatus is the boiler which drives the organic machine, and that its chemical activity and its integrity and correct mechanical action are equally important for the creation of the energy required.

Of Haller, the great Swiss physiologist, it would be pleasant and profitable to say something more than a mere word, did time and space allow. As Foster says, "When we turn from any of the preceding writers on physiology and open the pages of Haller's 'Elementa,' we feel that we have passed into modern times." He reviews the phenomena of the living body, he describes the anatomy, gross and minute, the physical properties of organs and their chemical composition so far as known. He records his own observations and those of others, and finally, with all these data clearly before him, he draws logical conclusions from the ascertained premises.

Haller's opinions on digestion concern us now, and

briefly they are these: Saliva is neither acid nor alkaline, and is useful merely as a solvent to help deglutition. Of importance is the stomach digestion; in the stomach is the tunica villosa, from the glands of which mucus is secreted, the true gastric juice coming from the arteries. He takes no account of a nervous fluid which had been said to aid in gastric digestion, and therein he differs from Boerhaave and the older writers. He looks upon the gastric juice as neutral in reaction, and, like Barry, asserts that whatever acid is present is a token of the degeneration of digested food, for the characteristic of *living* animal tissues is alkalinity, not acidity. Trituration by the muscular action of the stomach he regards as important.

Following Malpighi, he asserts that bile is derived from the liver, not from the gall bladder; it is a neutral fluid, with the power of emulsifying fats, and so dissolves the chyme of the stomach into the chyle of the duodenum. He recognizes value in the pancreatic juice, though its digestive properties are not entirely apparent to him.

Important as were these conclusions of Haller, they were, of course, far from final, and for nearly a hundred years thereafter the processes of digestion continued subject to study and discussion by many ingenious observers. De Réaumur (1683–1757) in 1752 published a paper[1] in which he demonstrated that the gastric juice dissolved various kinds of food, and by a process quite opposed to putrefaction. Spallanzani (1729–1799), by a large number of original and daring experiments, such as swallowing and withdrawing sponges, con-

[1] Memoirs of the Academy of Science of Paris.

firmed these observations; and though he failed to recognize the essential acid present, he showed beyond peradventure and established beyond subsequent doubt the fact of the solvent power of gastric juice in itself, without the intervention of putrefaction or any known form of fermentation. These men went far beyond the teachings of Stahl and the earlier physiologists, who called in to their aid an "archeus" or a "sensitive soul" to stand behind and explain vital phenomena. It is instructive and somewhat surprising to see John Hunter, whose conclusions regarding gastric juice were essentially those of Spallanzani, still harking back to a coincident and essential underlying cause, to which he assigned the title "vital principle."

Let us observe the situation, as it developed itself one hundred years ago, seized upon and explained by a young American physiologist, Joseph Glover, who published his thesis in the year 1800.[1]

The thesis is carefully prepared; all available authorities are cited, for his reading seems to have been wide and judicious; and the conclusions of others are submitted to the test of numerous ingenious experiments of his own.

After describing with much accuracy the anatomy of the parts, he agrees with Barry that the heat of the stomach is essential to proper chemical action, but that there is no actual gastric cooking done, as Blumenbach had claimed.

Trituration, too, as an essential in human digestive

[1] Joseph Glover, "An Attempt to prove that Digestion in Man depends on the United Causes of Solution and Fermentation." Philadelphia, 1800.

processes, he discards, for he regards the muscular mechanism of the stomach as a sort of dumb-waiter only — useful to push along its burden.

So this is his conception — food is ground in the mouth and mixed with saliva, which acts as a lubricant; and the saliva, when finally in the stomach, has the property of promoting both fermentation and putrefaction.

Gastric juice, obtained by killing dogs and by self-induced vomiting, he finds to be a colorless, turbid fluid, without taste or smell, very similar to saliva in appearance, so that, quoting the experiments of Barry, Haller, Spallanzani, Scopoli, Hunter, and Rush, he "thinks it appears sufficiently clear that an acid does not exist naturally in the gastric juice." But, he goes on to say, basing his opinion on the records of others and on his own experiments, the gastric juice is quite capable of digesting all species of *animal* and *vegetable* food; and he observes that, according to Jacquin, Spallanzani, and others, the gastric juice of itself has little tendency to either fermentation or putrefaction; but when mixed with other substances its effect is rather to retard those processes.

Like most of the writers of the period, he has a good deal to say about the mucus of the *Primæ Viæ*, which he regards as a lubricant rather than as a solvent.

Then, there is the bile: he has some rather feeble ideas of the bile. He says it is composed of: "1. A coagulable lymph; 2. A resinous matter; 3. Animal gluten; 4. Soda; and 5. A coloring matter which is believed to be iron." He proceeds to remark that bile is not miscible with fats and oils, but that it neutralizes

acids, separates the chyle from the chymous mass, exterminates the fixed air from the alimentary canal, dissolves accumulated mucus, stimulates peristalsis, and acts generally as a valuable antiseptic. So it will be seen that he grasps at some of the functions of the bile, but misses the first and most important, — its action in assisting the digestion of fats.

As to the character and action of the pancreatic juice, our ingenious American is very much in the dark, but he is in good company. He begins by describing the gross appearances of the gland, — the uses of the microscope were evidently known to him, — and remarks that its secretion is very like saliva; noting ingenuously that its duct "has very properly gotten the name of the pancreatic duct." He was a keen observer, however, and described the supplementary duct of Santorini. As to the function of the pancreatic juice he is not clear, observing that the pancreatic juice attenuates the bile, dilutes the chyme, and assimilates it to an animal nature.

From all these premises our essayist briefly draws two conclusions: that the solution of food is the first and most important action of all these juices of the body; and next, that this dissolved mass is then readily fermented by the action of the digestive secretions, especially by those of the stomach.

It is all very ingenious, when we consider the lights he had upon his problem, and not the least interesting part of the essay is the description of numerous experiments on animals and on human beings, experiments which would not be altogether unworthy of the modern physiologist.

Next we come to the nineteenth century, and are upon the threshold of that expanded method and knowledge of which Bichat was the prophet, during the very years in which Rush and his pupil Glover lived and wrote and in which Spallanzani died.

Much had been done to explain the gross anatomy of organs, something of their minute structure had been studied. Physicists had exploited mechanical possibilities, claiming all where little was needed; chemists had assigned to ferments and to obscure vital forces the phenomena observed; and judicious physiologists had reconciled the best learning of all the schools. So in a fashion, out of much nebulous discord, appreciation of the nature of digestive *processes* at last was beginning to take form; but in the study of *disorders* of digestion, of the nature of pathological changes, and last of all, of logical measures for the relief of sickness, chaos still reigned.

It would be fruitless here and now to rehearse the many vague old notions of the nature of digestive disorders. Some of the knowledge founded on *post mortem* findings and experimental research on animals was final and good, much more was immature and bad, and still more, again, was the result of metaphysical vaporings and the theories of the masters. But the clinicians were not mean practitioners. Though their diagnoses were amazing, their senses were highly trained, and their prognoses were shrewd and reliable. What then, since the days of the ancients, had been their therapeutic improvements in the treatment of these abdominal disorders? Truly of the most meagre kind.

Valentine and Paracelsus had indeed preached that

drugs should be employed to secure the chemical reactions required, and their belief, in halting fashion, had secured some few rational results; but mostly through all time, and even until our own day, dosing had been based on clinical experiences, — empirical therapeutics was universally followed. We took note in passing that among the ancients exercise, bathing, emetics, and cathartics were the measures employed to keep the body in good condition and to relieve digestive distress. Hippocrates credited black bile with being the offending agent in all these troubles. He gave vinegar to dissolve it, and hellebore as an emetic. His cathartics were mezereum, rhamnus, elaterium, colocynth, scammony, and aloes. Opium was used to quiet pain, and *Atropa mandragora.* These were the drugs and such were their uses for hundreds of years. Galen's *materia medica* did not differ essentially from this, and his theory of pathological changes was no more rational. So it went on through the Middle Ages. A few new drugs were added to the list, especially some of the metallic compounds; but clinical experiment ruled always, and the treatment was of symptoms largely. Paracelsus believed that there was a specific for each disease, and he used mercury for syphilis; but we have seen that he ignored anatomy, and of diagnosis he knew nothing.

The humoral theory died, specific drugs were sought, — there was cinchona, discovered to be the panacea for malaria, — and out of the studies of the iatro-chemists came certain obvious remedies for "acid stomach" and the like; but of accuracy in prescribing there was as yet no sign, because as yet accuracy in diagnosis was unknown.

For many years before the teaching of Boerhaave and Haller, — indeed, since the days of Paracelsus, — there had been evident a simmering discontent with the therapeutics of digestive diseases and a marked divergence in the views of the chemists and physicists; the former seeking and claiming correctives and panaces; the latter, though using drugs of a stimulating nature, such as tinctures and bitters, still assuming an attitude of more or less scepticism. This was to be expected from men who believed digestive processes to be of a mechanical nature only. When the more accurate researches and teachings of Haller and his followers came to prevail, the general confidence in drugs was restored, to a great extent. Such clinicians as Cullen, Brown, and Rush went so far as to claim almost miraculous results from their measures, and to point out the immense improvements made in their own time; but it is a significant fact that these men and others were the advocates and founders of schools of nosology and therapeutics, that they differed from each other more or less widely in their teachings, that many of them flourished by fitting their facts to preconceived theories, and that they disputed the claims of their rivals. In other words, there was no uniform and accepted basis of scientific thought in therapeutics, for the science of rational pharmacology was not yet born. Autopsies were rare, except for the investigation of dire conditions; the abdomen in the living practically never was opened; diseases of the liver, bile-ducts, stomach, intestines, and pancreas were a *terra incognita* almost; gall-stones and malignant growths were occasionally recognized, and there accurate knowledge ceased.

As we come down into the nineteenth century, it is instructive to see how our scientific grandfathers struggled to make the new conceptions of physiological processes and the knowledge derived from animal experimentation fit in with the new conceptions of chemistry. Chapman,[1] the famous Philadelphia teacher, writing in 1827, remarks: "To trace the multiplied relations of medicine to disease, the exercise of the higher faculties of the mind is demanded, and we at once introduce the spirit of speculation, or what is termed reasoning, in medicine.

"Nothing has been more prejudicial than the abuse of this noble prerogative. Consulting the records of our science, we cannot help being disgusted with the multitude of hypotheses obtruded upon us at different times. Nowhere is the imagination displayed to greater extent — and perhaps, says an eloquent writer, so ample an exhibition of the resources of human invention might gratify our vanity, if it were not more than counterbalanced by the humiliating view of so much absurdity, contradiction, and falsehood." [2]

When we remember that Chapman died within the memory of many men now living, and wrote more than twenty years after the death of Bichat, his attitude toward the subject of our study is surprising, but it reflected with much accuracy the opinion of his time. He vehemently asserts that if mere experience and accurate observation are to prevail, the well-trained nurse might be brought to excel the most accomplished

[1] Nathaniel Chapman, 1780 to 1853.

[2] Nathaniel Chapman, "Elements of the Therapeutics and Materia Medica," Vol. I, p. 46. Philadelphia, 1827.

physician; for our practice would become a blind routine, without reason or reflection, and medicine, instead of being studied as a science, would become a mere mechanical art, exercised only as a vulgar trade. "As well might we compare the mere flutterings of the meanest and the most grovelling bird with the bold and well-sustained flight of Jove's own imperial eagle, as those slow processes of a vulgar intellect by which facts are collected or observed, with the vigorous sallies of speculative genius, which seize truth, as it were, by intuition, and reveal it in a burst of light of celestial brightness." Still, we are told, that while we laud theory, we must not altogether despise the humbler employment of observation and experience, for we must remember that before we can raise the edifice the materials must be supplied, which can only be done by the unwearied exertion of this inferior species of diligence.

"Nor is it true, as has been commonly thought, that a precise acquaintance with the vital principle is indispensably necessary as a prerequisite to the advancement of our science. The nature of a principle may remain inscrutably concealed and still the law of its action be perfectly determined. Of this, the modern or inductive philosophy affords many striking proofs, in the specimens of its more splendid generalizations. Availing ourselves of the privileges we possess and animated by the noblest impulses, let us cordially cooperate to give to medicine a new direction and attempt those great improvements which it so imperiously demands. Even if we should not arrive at that point of absolute perfection which has sometimes been, per-

haps too sanguinely, predicted, we may at least, by infusing into the science the genuine spirit of reason and philosophy, render it richer in glory and more fruitful in benefits to mankind."

This curious commingling of logic and error, of optimism and exaggeration, you will find to be common enough in that generation. Rush and Cullen so wrote a few years earlier, and even Gross strayed in the same direction forty years later; but with such fine writing and assurance we have less and less to do as time goes on.

Taking up the question of the physiology of organs and the action of drugs, Chapman plunges on with calm conviction. He tells us that if there is any one thing admitted on all sides, it is that the operation of medicines does not depend on any of the common laws of matter, but on a principle, obscure and unfathomable, incident to vitality alone.

"Medicamenta non agunt in Cadaver,"

a piece of bad Latin which is doubtless true, but does not prove his assertion; and he quotes with approval William Hunter, who said that the stomach has a chemistry of its own and carries on processes totally unlike those of the laboratory.

When we remember the generous enthusiasm and real eminence of Chapman, it seems unfair to cite his misconceptions at too great length; but his arguments were those of his contemporaries and illustrate the history of the times. For instance, he tells us[1] that to reach the circulation medicines must pass either by the lacteals or lymphatics, for he disbelieved entirely in venous absorp-

[1] Vol. I, p. 54.

tion. Mr. Hunter had disproved this antiquated doctrine of venous absorption, he says, "yet I do not doubt of the existence of absorbents, of the nature of lacteals, which arising in the intestines, terminate in the portal circulation." And he goes on to show how the medicines are so neutralized by the "preparatory processes of animalization" that they are deprived of all activity. Chyle is chyle and blood is blood; the two are quite similar in composition and are quite uniform in quality, regardless of what drugs you may pour into the stomach. So it was clear to him that the process of assimilation, no matter how performed, reduces all substances to a homogeneous fluid, but when thrown into the secretions or excretions, being outside the control of vital energies, chemical affinities are sometimes again brought into play, and here the substances, be they drugs or what you will, are in part or wholly regenerated. This explains to him how certain substances are to be found in distant parts, but cannot be found in the blood flowing to those parts; as garlic in milk, sulphur in sweat, etc. Certain it is, he continues, that even the mildest fluid, as oil or *pus*, cannot be injected into the blood-vessels without occasioning the most fatal consequences.

Chapman admits, however, that the whole subject is shrouded in mystery, uncertainty, and doubt; he quotes Lee, Everard Home, Caldwell, and Brodie to show how the opinions of the best men differ and how the evidence is accumulating that drugs do not act directly through the blood, but by means of some obscure chemical or sympathetic reactions as yet unknown to us; and in order to illustrate the untrustworthiness of the best observers, he cites Boerhaave as stating "that he once

saw with his own eyes, and hence could not be deceived, in the semen of a ram, the germs of the future animal following each other exactly like a flock of sheep entering a pen."

We need not pursue this subject further, for Chapman published on the eve of some of the important discoveries which illuminated and gave a new impetus to the whole question of the physiology of digestion.[1]

It is the fashion of writers to assert that modern scientific thought began with Vesalius or Paracelsus or Haller or Morgagni or John Hunter or Bichat or some other, according as such writer's interests and studies prompt. As a matter of fact, no man may say when scientific thought began, and Huxley tells a story which

[1] The extraordinary self-confidence of the men of Chapman's time, and a little earlier, is illustrated by the following quotation: Speaking of Benjamin Rush, "His own sublime faith in the treatment (of yellow fever) is shown by this entry in his note-book of September 10, 'Thank God! out of one hundred patients whom I have visited or prescribed for this day I have lost none.'

"That is the sort of thing which runs through his writings. It is that sort of joyous and enthusiastic optimism which gives pause to the modern observer, with his exact methods and his critical and sceptical mind. What, pray, is one to believe if Rush could write such stuff as this, which implies, if it does not assert, that he had found the certain cure for yellow fever?

"Yet that was his genuine belief. The credulity of those men was often thus manifested, and in another place Rush himself tells us that 'The pulmonary consumption . . . even when tending rapidly to its last stage has been cured by bleedings, digitalis, and mercurial salivation;' 'Gout has been torn from its ancient sanctuary;' 'Dropsy is cured;' 'Tetanus is prevented by inflaming the injured parts, . . . and often cured by opium, bark, and wine;' 'Madness has yielded to bleeding, low diet, mercury, etc.;' and 'The last achievement of our science consists in the discovery and observation of the premonitory signs of mortal diseases, and in subduing them by remedies in their forming state.'" ("A Narrative of Medicine in America," by J. G. Mumford.)

leaves us to suppose that the inductive method is older than history. All those men whom we have named bore more than their share in the development of science; many of them were far in advance of their times, but though they may have thought on lines original with themselves, we may be certain that they owed much to their predecessors, and that if they themselves had not lived some others doubtless would have been found to do their work. Evolution does not depend on any one man or group of men. So in the development of our knowledge of digestive processes we find lights here and there appearing, but successively appearing, — often in unexpected quarters; at times indeed the wheels seem to be turning backward, but in the long run progress surely is made.

Now in the first half of the nineteenth century, while for a time it seemed that medical knowledge of all other kinds was advancing rapidly, we find but two names which stand out conspicuously as exponents of the physiology of digestion. Other names there are, to be sure, but these two are notable, — William Beaumont (1785–1853), the American army surgeon, and Claude Bernard (1813–1878), the French poet turned scientist.

It was Beaumont, as we know, who treated and took into his service Alexis St. Martin, the Canadian boatman with a gastric fistula, resulting from a gunshot wound; and by a long course of careful observations, on the lines already tried by Spallanzani, Réaumur, and so many others, came to reliable and definite conclusions regarding the nature and action of gastric juice. This work he did between 1825 and 1832, and he published in 1833. First, he established the fact that the active

agent in stomach digestion is an *acid* fluid secreted by the walls of that organ; second, that this fluid is poured out only during digestion; and finally, that it acts on food outside the body as well as in the stomach, if kept at a temperature of about 100° F. He also made other important investigations regarding the effects of various stimulants on the secretion of the stomach, the rate at which digestive processes take place, the digestibility of varieties of food, and on numerous similar problems.

These inquiries of Beaumont made an immediate impression, and when in addition to his writing he volunteered to demonstrate his patient and his method, the profession was stirred to an unusual attention and interest.[1]

Besides the chemistry of the stomach, Beaumont investigated the peristaltic movements of that organ. He described them as due to the alternate relaxation and contraction of the longitudinal and circular fibres of its muscular coat. He concluded that the muscular coat begins its contractions when food enters the stomach, and acts in such a way that the stomach contents are carried first to the left, then down along the greater curvature and on to the pylorus. Then the circuit continues up along the lesser curvature and so back to the cardia, the course being repeated again and again so long as any contents remain in the stomach.[2]

[1] See letter in *Boston Medical and Surgical Journal*, Vol. IX, p. 94, 1833.

[2] By such means he studied the digestibility of various foods and established the following table of time required: —

Pigs' feet	1 hour.
Tripe	1 hour.

It would be interesting to follow Beaumont through the experiments and text of his book. He was the first physician to take advantage of such a rare opportunity as was presented to his hand, and although gastric fistula has now become a commonplace of surgery, Beaumont established and worked out to a satisfactory conclusion many of the problems which up to his time had puzzled the physiologists.

Important as were the researches and conclusions of Beaumont on gastric digestion, still, he was working in a field that had been tilled already; but at the time of his publishing, the even more important question of pancreatic digestion was quite unsolved. It was Claude Bernard, some fifteen years later, who gave us our first satisfactory explanation of the value of the pancreas, and especially as regards its action on fats. We have seen how former observers had noted that so long as the various forms of food remain in the stomach they are unchanged in their essential properties, and are merely melted by the warmth of the stomach and its secretions. The fact that *chyle* differed from *chyme* was set down by the older writers to the action of the bile and the *succus entericus*. Bernard went to work to solve the question as to just where the change takes

Trout	1 hour 30 minutes.
Venison steak	1 hour 35 minutes.
Milk (boiled)	2 hours.
Roast turkey	2 hours 30 minutes.
Roast beef	3 hours.
Roast mutton	3 hours 15 minutes.
Veal (boiled)	4 hours.
Salt beef boiled	4 hours 15 minutes.
Roast pork	5 hours 15 minutes.

place, by experiments on rabbits, in which animals the duct of Wirsung opens into the intestine about eight or ten inches below the common bile duct. He fed his animals on oily food or injected melted butter into their stomachs, when on opening the abdomen he found that there was no chyle in the duodenum between the biliary and pancreatic ducts, but that it appeared abundantly below the orifice of the latter. Above this point, also, he found the lacteals empty or translucent, while below it they were loaded with white and opaque chyle. These conclusions were soon confirmed by the experiments of other observers, both in Europe and America, and so the true importance of the pancreas came at last to be understood, though only within two generations of our own time.

The activities of Bernard in the study of the phenomena of digestion were by no means limited to his work upon the pancreas. The next object of his concern was the liver, in 1848,[1] and a few years later he published his well-known description of the *glycogenic function of the liver.*

At that time it was supposed by the more enlightened physiologists that the liver acted merely as a filter and secreted bile. Here was a new, startling, and supremely important fact developed. It had long been known that sugar was to be found in the organs, tissues, and secretions of the body. And it had been observed that in certain diseased states sugar was eliminated in the excretions. But it was supposed that this sugar came directly from the food ingested. The experiments of Bernard showed that most of the sugar of the body has

[1] "Nouvelle Fonction du Foie." Paris, 1853.

an internal origin and he concluded that it appears first in the substance of the liver. He was struck especially by the fact that sugar may be recovered from the liver long after all external sources of supply have been cut off. As an experiment he kept two dogs for three and eight months upon a diet of calves' heads and tripe. They were then killed, when the liver was found to contain sugar fully equal in amount to what exists there under conditions of ordinary mixed diet. This fact of the constant presence of sugar in the liver Bernard found to be true in the great variety of vertebrate animals which he examined.

He concluded, also, that this liver sugar closely resembles other sugars, but is not identical with them, and is distinguished by the fact that it readily becomes decomposed in the blood; whereas beet and cane sugars, if injected into the veins, are discharged practically unchanged and undiminished in the urine; and milk sugar and glucose, if injected in large amounts, pass from the body in the same way. By a further series of ingenious experiments he showed that the sugar-producing function resides in the liver tissue itself, as a liver taken from a freshly killed animal, washed thoroughly, and laid aside for a few hours will at the end of that time be found to have become highly saccharine.

These observations of Bernard have subsequently been confirmed and amplified by great numbers of observers; with the investigations by Beaumont they constitute what we may regard as the initial work of the physiologist of to-day.

The technique, the definite purpose of the workers, the new chemical knowledge which was brought to

bear upon these questions, and the importance of the results obtained place Beaumont and Bernard truly among moderns; and with this brief sketch of their achievements in the field of physiology let us bring to an end this historical review.

CHAPTER II

METHODS

So many have been the devices applied to investigations of pathological conditions arising in the abdominal region, that it is well at the beginning to consider what every one who would study abdominal diagnosis must know, in order to secure results which can be depended upon. Many of the procedures recommended in text-books are laboratory exercises which waste time, annoy the patient, and often yield misleading results. In the face of clearly marked clinical symptoms there is no test furnished us by the laboratory which may not be open to reasonable doubt. This is true even of such well-marked tests as the Widal reaction and that for the bacilli of tuberculosis.

There is no short route to absolute knowledge of abdominal conditions. There are laboratory and mechanical aids to clinical diagnosis, but they are valuable only when weighed and considered in their relation to the case under consideration. No laboratory man can sit at his desk and dispense diagnoses, much less prognoses and working hypotheses for lines of treatment, without a thorough knowledge of the case in hand. In every way the laboratory man is, or should be, the assistant of the clinician. On the other side, the clinician who appeals to the laboratory man to furnish him with a ready-made diagnosis or prog-

nosis, is trying to avoid his duty to his patient. This is not to be taken, of course, as meaning that the busy physician shall not ask the expert microscopist to tell him what is present in a specimen of urine; to ask him as to the presence or absence of bacilli of tuberculosis or gonococci in a given specimen, or to ask the chemist to make for him an analysis of gastric contents. All that is quite proper. Even the busiest man will, however, find that his own small laboratory will yield him for the most part all the practical results he may need to ascertain the necessary points in his case.

The clinical history and observation of a given case are by far the most important things in making a diagnosis. Possibly in the case of nervous patients alone is there as great a need of a careful study of the history as there is in the case of gastric patients; and be assured that it will often take several sittings with the patient to get him to tell, with any degree of accuracy, the symptoms from which he has been suffering. The abdomen is so large a region, and ideas in regard to it are so vague, while at the same time the layman's notions as to indigestion and constipation are so indefinite, that accurate statements are hard to obtain and must often be sifted and resifted in order to get at the facts. On the physician's side, too, there is the danger of getting a preconceived idea as to what is the matter, and not listening to the patient's account of important details which should put him on the track of the real lesion. Another source of error in the early stages of serious cases is the personal equation of the patient. He runs in to see the physician, asks for relief of constipation, colic, or indigestion, refuses to stop at

that time for a careful consideration of his case, promises to return after his trip to New York or when business is a little easier, and does not appear again for some weeks, maybe months, and then often with the bewildering statement that the medicine did him no good. Later you may find out that in the meantime he has consulted several other physicians in the same way and also all of his friends who are of a prescribing turn of mind. The physician must be a well-rounded man who can interpret accurately into terms of pathological anatomy the perplexing statements of his patient, his own findings in the course of his physical examination, and decide what laboratory aids he must employ to verify his opinion.

Therefore, together with the development of the receptive discriminating brain, goes the education of the hands and the sense of touch; for on the delicacy of this depends much of the physical examination of the abdomen.

Of the aids to diagnosis, first and foremost comes a knowledge of anatomy — normal anatomy, the anomalies, and pathological anatomy. In the consideration of a given quadrant, or part of the abdomen, there should be the accurate picture of the underlying organs, the possibility of there being a congenital malposition, fortunately rare, and then of the pathological conditions which may arise in or about these organs. Next in importance will come a consideration whether the physician has to do with a symptom-complex, or with a condition arising in a special, single organ. The uterus, the kidney, the stomach, the ovary alone, may give rise to symptoms, and the diagnosis may thus be

made easy; or the symptoms may involve several organs and make difficult to determine the best point of attack for the relief of the patient.

There are two errors into which the clinician may fall: he may conceive too great a desire to make an absolute diagnosis, to narrow all cases down to some single lesion, and ignore accompanying pathological conditions which are present in other organs; or, on the other hand, he may incline to treat the prominent *symptoms* only, — not searching in some distinctly local lesion for the possible underlying cause. The latter tendency leads men to treat many definite stomach and intestinal lesions as dyspepsia, while the former error has brought surgeons, especially gynecologists, into disrepute.

When considering anatomical questions, it is well to remember that for descriptive purposes we must divide the abdomen into quadrants. (This division should be adhered to in record-making rather than the older and more complicated and inexact divisions.) From a pathological, or rather surgical, point of view we may divide the abdomen into the pelvic region, most important in women; the appendix region, the danger spot of young adults; the kidney region; and finally the region of those complicated anatomical structures centering in the duodenum.

Surgery is no longer concerned merely with the repair or removal of *obviously* diseased organs or parts. Through surgery we propose to prevent serious illness by the removal of *inferentially* harmful tumors, adhesions, and such other trouble-producing foci.

In the pelvis the anatomical points to be kept in

mind are the relation of the uterus and adnexa to the symptoms under consideration. All of these symptoms are given in detail in the treatises on gynecology. The bimanual examination of the pelvis must be thoroughly understood, whether such examination be practised through the vagina or rectum. Especially in the examination by rectum is it to be borne in mind that special information can often be obtained in regard to ptoses. In many cases the lax pelvic floor and general loss of abdominal tone is shown by the collapsed condition of the rectum. The examining finger, instead of entering a dilated ampulla, capable of acting as a resistant air cushion, on which the intestines can rest, finds its progress blocked by collapsed walls, and often no outlet into the sigmoid region is to be had at all. This condition is more common in men than usually is believed. Often it is accompanied by symptoms similar to those seen in women with prolapsed viscera.

In the appendix region, besides the acute, chronic, and secondary inflammatory processes of that organ, there may arise tubercular and malignant lesions. Below, diseased tubes and ovaries may, by adhesions, simulate appendiceal symptoms; while above, the nearly related gall bladder and ducts, the diverticulum of Meckel, possible mesenteric thrombosis, or strangulated hernia, all serve to make diagnosis difficult.

The renal regions, while not so complex or important as the two regions just mentioned, have to be taken into consideration. Stone and tuberculosis and new growths make up, with abscess, the conditions demanding surgical interference; while malpositions are common, and may lead to perplexity in diagnosis on

account of their relation to the complicated duodenal region on one side and to the spleen and retro-peritoneal area on the other.

The great region of diagnostic perplexity, as has been several times pointed out, is found in the region of which the duodenum is the centre; and this region lies immediately behind the upper portion of the right rectus muscle, which, in response to all possible stimuli, contracts in such a manner as to complicate further the almost insuperable obstacles to diagnosis.

Secondary changes in the stomach, resulting in dilatation and prolapse, are looked for to the left of the median line. They are easily made out by the use of appropriate methods; but the pyloric portion, where by far the greater number of the primary lesions arise, with the immediately succeeding portion of the duodenum, into which empty the gall-ducts and pancreatic duct, lie in this area, overshadowed by the edge of the liver. The difficulties of diagnosis are enhanced by the fact that there is a group of symptoms, subjective for the most part, which may indicate indefinite pathological disturbance of all these structures. Such symptoms are usually called "dyspepsia" by the laity, and often by physicians. They include attacks of discomfort or distress, amounting at times to real pain, accompanied by a sense of fulness and the belching of gas; while not infrequently vomiting is to be included in the list. Renal and intestinal conditions, as well as gall-duct disease, may further complicate the diagnosis by giving rise to a similar train of symptoms.

This duodenal region is the battle-ground of modern surgery, which the progressive operator seeks to conquer

as thoroughly as he has conquered the pelvic and appendix regions. In part the surgeon has succeeded already, for the problems of surgery of the biliary tract are now concerned mostly with matters of minor detail in technique. Each organ must be considered separately, yet all must be considered together in order to arrive at a just conclusion; and even after a careful study of the whole field, one may be forced to turn to an exploratory operation to find out the exact condition; and it must be admitted from the study of reported cases that this procedure — nay, even a post-mortem examination — at times fails to reveal the exact cause of symptoms apparently located behind the upper portion of the right rectus muscle.

In spite of these difficulties of diagnosis, much may be learned by a careful preliminary consideration of the clinical history, and by the use of the various aids to diagnosis which it is possible to bring to our assistance.

Fortunately for the general practitioner, these aids usually are simple, and can be employed by himself alone or by his assistant. Next to the carefully obtained and well-considered history comes the physical examination of the patient, and a correlating with the symptoms of all the facts found during this examination. Then one is in a position to see what further laboratory tests may be wanted to clinch the conclusions so far reached.

It seems almost unnecessary to enumerate the more important means of physical examination of the patient, but they are four in number: inspection, palpation, — which includes digital examination of the rectum and

vagina, — percussion, and inflation of the stomach and rectum. Auscultation rarely may be of service.

Inspection of the abdomen at once gives certain information as to the general nutrition of the patient; while deformities of the costal border, distention, or retraction may show at once the gravity of a given case. The appearance of lineæ albicantes may alter one's ideas in regard to the chastity of the patient; previously unmentioned operations may be indicated, while lax abdominal walls, as well as more particular points, suggesting tumors and ascites, may appear. By placing the patient in a proper light a good outline of the prolapsed or dilated stomach may be seen, doing away with the necessity of subsequent inflation. Peristaltic movements may be of great significance, pointing directly to the diagnosis. Dilated veins may speak eloquently of hepatic disease or portal obstruction.

It must not be forgotten, in a consideration of the causes of digestive disorders, that inspection includes a careful examination of the teeth and gums.

Palpation will go hand in hand, as it were, with inspection; it will confirm the impression of obesity, it will make certain that there is the "boardlike feel" so characteristic of severe general peritonitis, it will demonstrate the contracted muscle overlying an inflamed area. Through a thin-walled abdomen the pulsations of the aorta are to be felt, and must be considered as suggestive of aneurism or prolapsed viscera. The outlines of the enlarged liver and spleen and of the movable kidney, and definite tumors, are thus marked out. Here various postural devices are of use to effect the relaxation of the abdominal muscles, thus allowing of more

accurate palpation, or the differentiation of tumors of the abdominal walls and movable organs from those taking their origin from the retro-peritoneal region, or from the deeper fixed organs. Therefore, aids given by the mechanical procedure of flexing the thighs, with the patient on his side or in the "knee chest," "hands and knees," positions must not be forgotten any more than the examination by the vagina and rectum in appropriate cases. Complete relaxation may be obtained by immersing the patient in a hot bath. Smoothness, hardness, roughness, and elasticity of presenting parts are all to be noted carefully, and waves made by free fluid or splashing within the stomach and intestines are to be recognized.

Percussion, rightly employed, will tell much as to the outlines of the organs both solid and hollow, as well as the shifting dulness of ascites and unusual tympany of gas above the liver.

Except for particular search after the placental *bruit* and the fœtal heart, and for sounds in the large vessels, but little can be ascertained with the stethoscope excepting gas movements within the intestines.

The fourth method of investigation is inflation of the stomach or rectum to give accurate information as to the size and situation of the stomach or colon. There are two ways to accomplish this in the case of the stomach, — by means of gas or by the stomach tube. To use gas from twenty grains to a teaspoonful of bicarbonate of soda are administered in part of a glass of water, immediately followed by a slightly less amount of tartaric acid, also dissolved in water. To each dose simple elixir may be added to make it palatable.

This procedure will enable the observer to obtain the outlines of the stomach when, for any reason, passage of the stomach tube is undesirable, for the tube is unconquerably disagreeable to some people; but the tartaric acid method has its dangers. The stomach tube, to dilate the organ, can always be utilized after the removal of a test meal. This can be accomplished quickly by blowing down the tube through a clean glass mouthpiece or by means of a bulb syringe. Water also can be poured into the stomach until the patient indicates his desire to have the process stop, when the amount is noted as it is siphoned off. The distention with air should not be carried beyond the point of discomfort to the patient. During the examination, the dilatation of the stomach is maintained by sharply kinking the tube, and after the manipulation all the air should be expelled by pressure on the stomach before the removal of the tube.

In dilating the large intestine, although it can be done with the short rectal nozzle of a Davidson's syringe, it is best to use a soft rubber rectal tube. The percussion outlines of the abdomen are to be known before beginning this procedure, and it is well to watch the distention carefully, for prolapsed organs may lie in practically normal positions when the colon is fully dilated. By this means the relation of the bowel to other organs and new growths is made out. The ordinary position of the intestine, whether normal or M-shaped, and the size of the sigmoid flexure become obvious.

A test meal for the study of the processes of digestion, in spite of many explanatory papers and chapters upon

the subject, continues frequently to be misunderstood, as well as misinterpreted. What we do, is to administer, on an empty stomach, a definite amount of food. This is withdrawn at a specified time and an analysis is made. The amount of gastric contents withdrawn, its appearance, and the results of the chemical analysis are then compared with the results obtained from similar meals which have been given to persons in health. By this means a standard for comparison has been obtained.

Although a large amount of work has been done by specialists in this field, the fact remains that but a small amount of this work has given returns of permanent clinical value. Indeed, the busy practitioner may make all necessary investigations with ease, and draw proper conclusions from simple tests. The discouraging part to the practitioner is that, after doing what seems like a good deal of work, he is rewarded by little new information, and so in his disappointment he is apt to think that had he only been an "expert" he would have obtained pathognomonic information. The attitude of the "expert" is quite the opposite. His study of stomach contents is a matter of routine, and he knows that he is fortunate, in the majority of cases, if he secures more than a single bit of information to help him make up the mosaic picture of disease which he is considering. His greater power comes largely through his facility in using a large number of names which express slight deviations from the general underlying condition.

It cannot be asserted too often that any laboratory analysis is valuable only when applied to a particular case.

There are two test meals which are of general prac-

tical value, the Ewald test breakfast and the test meal of Leube. The former is of the more value from the point of view of chemical analysis; the latter, when used, is a gauge of the digestive and motor power of the stomach under conditions of what would be generally considered normal as to both the quality and quantity of the food used at a meal.

The Ewald breakfast consists of a glass of water or tea without milk or sugar, and a roll or thick slice of bread, given on an empty stomach — usually at an early morning hour. (Water, 200 g. or 7 oz.; and bread, 35 g. or about $1\frac{1}{4}$ oz.) It is not usually necessary to wash out the stomach before the breakfast; if, however, stasis is suspected, it should be done. At the end of an hour the tube is passed and the stomach contents removed, at which time it has been found that under the conditions in which this meal is administered (in normal acting stomachs) the process of digestion is best studied. After the remains of the breakfast have been collected, lavage can be done without removing the tube, and the stomach may also be distended to show its position and shape.

Observations on the stomach contents that has been withdrawn should now be made. First of all, what is the amount? Under normal conditions there should not be more than 100 c.c., or three ounces, of fluid recovered. If there is more than this amount (150–200 cg.), there is probably motor insufficiency or hypersecretion, and if more is withdrawn than was given at the meal itself, stasis is suggested. In such cases, of course, all quantitative analysis of the contents is valueless, as such contents cannot be compared with those of normal conditions,

but examination should be made for hydrochloric, lactic, and other acids. Sometimes, on account of a rapid digestion and hypermotility, very little contents may remain at the end of an hour. If the stomach tube has been properly manipulated, this is a very significant observation.

If there is marked stasis, large quantities of contents should be recovered, in which case food from meals taken on previous days may be recognized. Next to the *amount* of contents its *appearance* will cast light on the condition of digestion. Much froth and mucus indicate a chronic process and tendency to fermentation. You may note here a separation of the contents into several layers; above all observe the state of digestion of the bread, which may appear as finely divided bread and water simply, or as well-digested material which one could not recognize as having been bread. The presence of foreign material, such as blood and bile, is to be noted and its importance considered. Brown particles do not always mean digested blood. Frequently you must resort to the test for hæmin crystals in order to be sure of their character. A few streaks of bright blood are of no significance. The reaction of the stomach contents *should be* acid, and there should be free hydrochloric acid (HCl) present.

The clinician will immediately measure out 10 c.c. of the gastric contents and add two to four drops of Topfer's reagent (dimethylamido-azo-benzol, 0.5 per cent solution in alcohol). A cherry or carmine red will appear if free HCl is present. If the reaction does not take place, it will be necessary to try Gunzburg's reagent (phloroglucin, 2 g.; vanillin, 1 g.; alcohol, 30 g.)

to confirm the observation. Large amounts of acetic acid may give so bright a reaction by Topfer's test as to deceive the observer; so if there is any question whatsoever, it will be well to make a control experiment by using this delicate Gunzburg test for the presence of the free HCl. Gunzburg's reagent has to be renewed frequently, as it decomposes in a short time.

Having obtained a reaction with Topfer's reagent, and free hydrochloric acid being recognized as present, the next question to be answered is, How much is present? This is told by titrating from a burette into the same glass which contains the 10 c.c. of stomach contents plus the few drops of Topfer's reagent, a decinormal sodic hydrate solution until the red color disappears. Under normal conditions 2 to 5 c.c. are required to accomplish this, and variations from the amount denote hypo- or hyperacidity. From the data already obtained preliminary deductions are now in order. An absence of HCl suggests cancer or an atrophic condition of the gastric walls. Absence of HCl does not *necessarily* mean cancer of the stomach, for free HCl may be present late in this disease. It was hoped at one time that an absence of HCl meant the presence of carcinoma ventriculi, but clinical experience has taught, in no uncertain language, that neither the absence of free hydrochloric acid shows that cancer of the stomach is present, nor does the presence of free HCl preclude the possibility of a cancer. There is no doubt, however, that the sudden appearance of gastric symptoms in a patient who is in the cancer period of life, there being nothing to suggest a dilated atonic stomach, together with the absence of hydrochloric acid, with no

tumor to be felt, certainly increases the probability of the case being one of cancer.

During a recent service of four months in the Male Medical Out-patient Department of the Massachusetts General Hospital, where it was the custom to analyze the stomach contents of all those who presented gastric symptoms of any standing, a single instance could not be found of increased hydrochloric acid secretion, but hypochlorhydria was very common indeed. Poorly prepared food, irregular hours, and alcoholic drinks appeared to be for the most part the causative factors in such hypochlorhydria.

Having ascertained the amount of free hydrochloric acid in the specimen which is being studied, the next move is to find out how much acid has entered into *combination* during the digestive process. For this purpose a drop or two of phenolphthalein (1 per cent alcoholic solution) is added to the same gastric contents from which the free HCl has been neutralized; then the specimen is titrated with the decinormal sodic hydrate solution until a red color becomes permanent. In normal cases from 4 to 8 c.c. of the sodic hydrate will be used to neutralize both the free and combined acids. By this process all the acid constituents are neutralized.

The elimination of lactic acid and the other organic acids by appropriate tests makes it sure that the total acidity is practically all due to the action of the hydrochloric acid. In order to obtain the percentage of free and combined hydrochloric acid, it is necessary to multiply the number of cubic centimeters of the decinormal sodic hydrate solution by the coefficient 0.00365, which

is the quantity of hydrochloric acid neutralized by 1 c.c. of the decinormal sodic hydrate solution; this gives the amount of actual free hydrochloric acid in 10 c.c. of stomach contents, which multiplied by 10 will give the amount in 100 c.c. of contents, and for this the percentage is easily obtained. For the free HCl the percentage will range from 0.07 per cent to 0.18 per cent, and for the total acidity 0.15 to 0.30 per cent will be within normal limits. These figures are stated differently by different authors, but broadly a free hydrochloric acid contents of 0.1 per cent to 0.2 per cent is normal, although the latter figure seems high for the American stomach.

The presence of lactic acid may be a factor in helping to make a diagnosis in a doubtful case. It may assist and clinch an opinion already formed, but it is by no means a pathognomonic sign. Lactic acid is due to the fermentation in the stomach of carbohydrate food, which is held longer than usual. At the same time there must be a low or absent hydrochloric acid contents in order to allow of bacterial activity in the retained food. A bacterial activity is usually present in pyloric obstruction, and such obstruction is most frequently due to cancer; too much significance has been put, in times past, on the value of this lactic acid sign. Fortunately, lactic acid is not a normal secretion of the stomach, nor is it found after the Ewald test meal in sufficient quantity to interfere with the simple ferric chloride test.[1] So we see that the presence of lactic acid means gastric stasis (from any cause) with fermentation. The same may be said of the detection

[1] See also Appendix.

of acetic acid or the fatty acids, except that when present they usually denote very complete stasis.

At times the motor sufficiency of the stomach cannot be determined satisfactorily by the presence of residue in the early morning, nor is the Ewald test breakfast a means sufficient to indicate the ability of the stomach to secrete free hydrochloric acid. Further distinctions are needed, so that often we must resort to a mixed test meal. This mixed meal consists of a plate of soup, a small amount of meat and bread, or potato, with a certain amount of water. This meal is withdrawn from the stomach at the end of several hours, when the conditions of digestion are inspected. The exact details of the procedure will depend on whether one follows the rules of Leube, of Riedel, or of Ewald. All three authorities seek practically the same end, but the methods of one may be slightly more applicable to a given case than those of another. Whichever plan is adopted, it may have to be repeated several times in order to meet the question which one seeks to answer.

Possible early information regarding beginning stasis may be obtained by fermentation experiments with the gastric contents, noting the time in which fermentation phenomena appear in a fermentation tube as compared with the time required by the contents of the normal stomach. If any such test is employed, it must be with reservations, as many persons habitually have sluggish digestions, — possibly due to some anomaly or pathological condition, — when, nevertheless, for years and years the individual may remain in a condition of good health. Should such a person have a gastric upset at any time there would be no special reason for alarm on

account of finding early fermentation of his gastric contents. In a person, however, who has experienced a craving for food regularly at the end of four or five hours after meals, an observation of early fermentation would justly excite apprehension.

Microscopic examination of the stomach contents may reveal the presence of yeast cells, sarcinæ, and other bacteria, as well as blood, and at times even bits of cancer or granulation tissue.

Blood is in all cases worthy of note, whether it be vomited or passed by the rectum. This, of course, does not refer to small streaks of fresh blood appearing after the passage of the stomach tube or after a severe attack of vomiting, or after a very constipated movement of the bowels. But large amounts of blood mixed with vomitus are of importance. Such blood is seen to be either fresh or modified by digestive processes. In the case of presumably vomited blood it is well to be sure that the hemorrhage did not have its origin in the pharynx or postnasal cavities. The blood will be bright red if vomited soon after being poured out into the stomach, but it is soon changed by gastric juice into the classic "coffee-ground" condition which is easily recognized. Small amounts of brownish material are frequently found which give rise to doubt, in which case we must resort to the test for hæmin crystals or to the guaiac color test.[1]

[1] Guaiac test: Fresh alcoholic solution of guaiac should be made by scraping with a knife a few grains of gum guaiac into a test-tube containing about 5 c.c. of alcohol, in which the guaiac quickly dissolves. It is better to select that portion of the gum guaiac appearing as yellow nuggets on the surface. A few drops of peroxide of hydrogen are added. The stomach contents or the watery mixture of fæces to be examined are

As to melena, unless in great quantities, blood is completely changed in its passage through the intestine so that it gives tarry stools. The origin of any unchanged blood coming from the rectum can usually be determined by a careful rectal examination.

Small amounts of digested blood in the stools of those who are suspected of having an ulcerated process in the pylorus or in the duodenum are valuable evidence of ulcer or neoplasm. Evidence of such "occult hemorrhages" usually can be found only after careful and persistent search. The amount of fat in the stools occasionally may have to be estimated to determine the intestines' power of absorbing fat. Sometimes the fæces must be screened to settle the question whether or not pain is caused by the passage of a gall-stone or a calculus of the pancreas.

In persistent diarrhœa the microscope may show in the still warm specimen the amœbæ coli as the cause of the flux; or after diluting with water, and letting the fæces stand for a few hours, examination of the upper layer may show bacilli of tuberculosis coming from ulcerations of the bowel.

The Widal reaction, when present in proper dilution, points to typhoid fever; but it must be remembered that the reaction sometimes has not been observed until

mixed in a test-tube with one-third their volume of glacial acetic acid and the whole shaken with an equal volume of ether. On standing, the ethereal extract, containing the hæmoglobin if present, will separate and occupy the upper portion of the mixture in the tube. A few drops of this ethereal extract are next added to the alcoholic guaiac solution, and if blood was present in the original material, a blue-violet color should appear in the mixture. So delicate is this test that meat in the stomach contents will give the blue color.

late in that disease, or even until the onset of a relapse.

The agglutination reaction of the blood to some of the para-typhoid group of bacilli possibly helps to explain a run of fever for which otherwise we should have no definite name.

The search for gonococci in cases of salpingitis is a useless waste of time for the ordinary clinician. Absence of the cocci from the urethral or vaginal secretions does not prove that the inflammation is not of gonorrhœal origin, nor does their presence mean change of treatment.

If it is desired to try the tuberculin test, be sure that the patient's lungs are carefully examined first of all; and use the X-ray, if possible, to verify the results, because it has been demonstrated that the proportion of people having some tuberculous lesion is very great, — some autopsy statistics putting the percentage as high as 98 per cent. It is, therefore, easy to see that by means of the tuberculin test a misleading answer may be returned to a question of doubtful abdominal tuberculosis, on account of a small lesion located in the lungs or other organs.

In all cases, a urinary examination should be carefully made, as experience has taught that sometimes renal disease will account for many apparent gastric symptoms which often seem so simple as to be called "dyspepsia."

The finding of pus or blood in any amount in the urine will, of course, suggest further persistent search for a definite lesion; and it may, in a few cases, be necessary to collect the urine from each kidney in order to make sure which kidney is affected. When we know that one kidney is diseased, it may be of great impor-

tance to know whether the other is also diseased, or is capable of doing the work of both. Finding bacilli of tuberculosis in the urine may call for a number of tests, including the inoculation of guinea pigs, to make sure that these are not simply acid-resisting smegma bacilli.

The X-ray will be found of value in locating renal and ureteral calculi. The best results are to be expected in the case of phosphate of lime stones. Under favorable circumstances, however, one may discover uric acid and calcic oxalate calculi. The X-ray is of no other aid in abdominal diagnosis, unless to indicate the location of a metallic foreign body. A large aneurism might be shown on the plate, but probably in no manner to give positive indication of its presence if otherwise the diagnosis were in doubt.

An examination of the blood by the quick-staining process of Wright [1] will give one a definite idea as to the presence of leucocytosis and possible acute leucæmia, — a condition which has been mistaken by competent men for an abscess condition. The blood examination will also show plasmodia of malaria if they are present. Such a discovery has saved patients from the operation for appendicitis in cases of malaria in which severe abdominal pain had been the most prominent symptom.

In some cases the apparent presence of a leucocytosis will make desirable repeated blood counts in order to keep track of any leucocytosis as an index of the advance of an inflammatory process. However, one must bear in mind that leucocytosis or iodophilic granules are not infallible guides as to inflammation

[1] *Journal of the Boston Society of Medical Sciences* for 1903.

and perforation of the intestine, but must be carefully considered in the light of all the other symptoms. When so considered, the presence of these phenomena is capable of rendering assistance in many doubtful cases.

Such observations cover practically the solid ground in the realm of laboratory aids. Other methods are suggested and are being carefully tested by enthusiastic workers, and it is hoped that some at least of these tests will come under the group that can be relied upon to give assistance in the majority of selected cases.

The methods of examination and laboratory aid given above require but little paraphernalia and but a small closet laboratory for their accomplishment. The doing them in each case, whatever may be suggested by the symptoms, and the thinking over carefully of each result will enable one usually to approach the correct diagnosis. Often, however, it will be found, when all has been said and done, that an exploratory operation only can settle definitely the vexed questions, and even this sometimes will fail to settle them.

A close attention to symptoms, and the refusal, except as a very last resort, to regard definite attacks of pain, nausea, and vomiting as nervous and hysterical conditions, will save a number of cases, or at least will allow the physician the mental satisfaction of making a correct diagnosis.

CHAPTER III

THE STOMACH

If one takes a file of any of the older medical journals which run back for fifty or more years, and looks through them chronologically for statements regarding digestive disorders, one gets a curiously vivid and instructive picture of the development of our present knowledge. *The Lancet*, *The British Medical Journal*, *Virchow's Archives*, the *Transactions* of the London Pathological Society, *The American Journal of the Medical Sciences*, and *The Boston Medical and Surgical Journal* have illustrated our theme, and in their study certain facts are noticeable: for more than half of that time one is impressed with the similarity of topics discussed, the infrequency, compared to modern days, with which writers mention abdominal diseases, and the almost total disregard of the great subject of treatment. Clinical histories are there in detail, and gross morbid specimens are described; but for many years no new therapeutic instructions of value were given.

Therefore, before entering upon the question of the present-day aspects of these disorders, it may be interesting to consider briefly some of the therapeutic views of the subject, so far as we may discover them, held at the beginning of our era, — forty years ago, — that we may make a comparison between the measures and results of that time and those of the present.

As regards this matter of digestive *therapeutics* thirty to fifty years ago, a fairly accurate knowledge may be obtained from the text-books of the time, as well as from the current journals. Take Fothergill's "Handbook of Treatment," which sums up the best of English practice; Flint's "Clinical Medicine," which does the same for America; and Niemeyer's "Practical Medicine," the popular German text-book of the time, and you will arrive at a very comprehensive knowledge of the views on therapeutics held at the beginning of our own era.

A fact striking to us, with our more curious and intimate acquaintance with processes in individual organs, is the former universal prevalence of symptomatic treatment, — a prevalence coming down almost to to-day. A reading of the text-books might seem to refute this statement, for definite, clearly described diseases are considered in them, and the appropriate treatment is indicated; but take the journal articles, with the records of cases, and you will find that the great majority of abdominal diseases were treated without any clear knowledge of the diagnosis, and that on those rare occasions when an accurate diagnosis was made and confirmed at autopsy, the complacency of the narrator was evident.[1]

Even in the text-books much of treatment is summarized under such headings as "Digestive Disturbances," "Dyspepsia," etc., so that to one reading, it is not altogether clear whether the writer refers to diseases of the stomach, the liver and bile ducts, the pancreas, or to conditions associated with all of these. That

[1] *Vide* Transactions Pathological Society, London, "Fatty Degeneration of the Pancreas," Vol. XXIV, p. 121.

man would be fatuous indeed who claimed that we are now free from such confusion; but since frequent ante-mortem examinations have come to supplement and supplant in a measure the infrequent old post mortems, our diagnostic accuracy has entered upon a phase previously impossible.

The treatment of symptoms is especially dwelt upon by Fothergill, who discourses in their order, interestingly and at length, about acute and chronic affections of the stomach. He dwells much upon the theory of emetics and their value, recognizing the *direct* agents, mustard, sulphate of zinc, sulphate of copper, and others, and the *specific* agents, ipecacuanha and apomorphia. The administration of these drugs was followed by that of gentle saline laxatives, and then a carefully regulated diet was enjoined until convalescence was established, — all of which differs in no essential from the practice of to-day. But it was the "permanent conditions" to which the acute attack might give rise which troubled and especially exercised the ingenuity of men of that time. As Fothergill remarks, "Gastric catarrh, ulcer, and cancer are affections whose treatment requires great consideration and much thoughtful application of physiological knowledge."[1] So, careful dieting, giving a little and often, was the rule then as now, but the anatomical conditions present were constantly regarded with misgivings and the outlook with uncertainty.

"When the causes can be removed by proper treatment," says Niemeyer, "the disease is often cured." But the causes are pointed out to be thickening of the mucosa and the submucosa, and changes in the mus-

[1] Fothergill, p. 365.

cular tissues; obstruction of the pylorus and dilatation of the stomach; while not infrequently ulcers of that organ and of the duodenum are followed by the formation of cicatrices, adhesions, distortions, still further narrowing of the pylorus, and increased dilatation with ptosis.[1] As regards the treatment of chronic gastric catarrh and its sequelæ, Niemeyer is sufficiently explicit. He forbids alcohol, prescribes warm clothing and warm baths, and lays down very precise dietary rules: lean meat in small amounts, broths, white bread, salt or smoked meats, skimmed milk, buttermilk, and soda waters, — and he concludes that "the results from this treatment are the most brilliant that are ever attained in medicine."

Drugs were little used by the writers of that time, as compared with the writers of a previous generation. Bismuth and the nitrate of silver were commonly employed, but were not greatly relied upon, and no local treatment by lavage was attempted. Just what Niemeyer means by calling his results the most brilliant ever attained is not at all clear, for he goes on to tell of the frequent serious results of this condition, the long illnesses, and the sometimes fatal endings.

The methods then employed in getting at accurate facts and end-results of treatment were not the painstaking statistical methods of to-day, so that it is impossible to gain a knowledge more satisfactory than a general impression; but that impression, as one gleans it from text-books, essays, and reviews, is not very cheerful.

Gastric ulcer was justly regarded seriously by the

[1] Niemeyer, Vol. I, pp. 495, 496.

writers, though it is evident from the reported autopsies that the correct diagnosis was very frequently overlooked — much more frequently than is the case to-day, one must believe.

One of the most interesting descriptions of gastric ulcer — a description written nearly fifty years ago in a letter from an American student[1] in Vienna — deals with the work and views of Johann Oppolzer, whose teaching embodied the best thought of the sixth and seventh decades of the century on the subject. After discussing the various forms of ulcer, their course, symptoms, and appearance, the writer deals with the treatment. Rest is the main thing, he says. With rest they may be healed in six or eight weeks without any medicine; that is a lapse of time somewhat longer than one concludes to be the finding of Greenough and Joslin, who published in 1899. But how to obtain rest? Food was given by the mouth, — a little and often. Milk was the great reliance, — sour milk, buttermilk, pure milk; no solid food when there was cardialgia but broths, gruels, and ices. Oppolzer thought ill of nitrate of silver, which Niemeyer prescribed ten years later. Indeed, the Vienna teacher showed that the only indication for drugs was to combat symptoms; for pain, opium and bismuth, belladonna, and counter-irritation; for hemorrhage, tannin, sulphate of zinc, acetate of lead, and ice. After all, careful dieting was the main reliance, though entire abstinence from stomach feeding and the use of nutrient enemata were not yet practised.

The writer noted with interest that chronic gastric catarrh and dilatation are often coincident with ulcer,

[1] James C. White, in *Boston Medical and Surgical Journal*, Nov. 5, 1857.

and concluded by observing, "From the frequent occurrence of this disease [ulcer] in Vienna, I am inclined to think that many of our cases of 'dyspepsia' might be resolved into the same, were we not so easily satisfied and blinded by that very unsatisfactory word, a word which I never heard used by Oppolzer." All this and more of the same kind sounds curiously familiar to modern ears.

When it came to cancer of the stomach, there was nothing to be done beyond symptomatic treatment: diet as in gastric catarrh, red wine; the alkaline carbonates or creosote for hyperacidity "due to pyloric obstruction"; aloes and colocynth for constipation, and morphia for pain. The point of greatest interest to us in these old discussions of cancer is the diagnosis, — its distinction from ulcer and chronic gastritis, and the question of its becoming implanted upon an ulcer. The differential diagnosis was of course difficult, and according to Andral was impossible unless a tumor was felt. J. Frank stated that there was no proof of cancer springing from ulcer, whether healed or unhealed.

Aside from the conditions already named, various other affections of the stomach are mentioned in the text-books; but they need not concern us except to induce the reflection that many of the more obscure symptoms, which were classified as "dyspepsia," "nervous dyspepsia," "cardialgia," etc., were probably due in part to visceral ptoses, which were first brought clearly to the attention of the profession by Glénard in 1885, though Virchow and Kussmaul and Oppolzer referred to the condition many years before. This and kindred matters we must consider later and at greater length.

Now there are certain lesions of the stomach in regard to which surgical opinion is becoming united in affirming that they are proper subjects for operative treatment. And internists, too, more and more generally are recognizing that in an operation alone lies any hope for permanent cure. As yet the lapse of years is not great enough to allow of extensive statistics regarding remote results; but if we can judge by the conditions seen three or five years after operation, we are justified in assuming that in proper operations, selected carefully to fit the individual case, we have a method of treatment far more promising than anything else as yet devised.

It seems as though the methods followed by internists for the relief of gastric disorders had been brought to perfection ten or fifteen years ago. Those methods may be summed up practically in two words, *rest* and *cleanliness*. Subsidiary means are used, to be sure, — appropriate diet and drugs; but the rest and the cleanliness are the leading factors, obtained imperfectly often, distressfully too, and maintained mostly with difficulty or not at all.

The surgeon also seeks to employ these two methods for the relief of gastric disorders, with what measure of success we are beginning in these days to perceive. The conditions for which surgical aid is employed are becoming more numerous, and doubtless will continue so to become. Let us then consider some of the more important stomach lesions, and, so far as results obtained may guide us, try to determine what course to pursue under particular conditions. Ulcer or cancer is at the bottom of most of the operable gastric disorders; but

for convenience here we may name in this discussion (1) Ulcer and its complications, Pyloric Obstruction, from whatever cause, Hemorrhage, Distortion of the Stomach, Adhesions, Tetany; (2) Spasm of Pylorus, (3) Cirrhosis, (4) Ptosis, (5) Cancer.

For the sake of the argument, and out of its logical order, we wish first to discuss *pyloric obstruction*, prefacing what we have to say with a word on the stomach tube, that instrument most useful for gastric diagnosis.

It is surprising that not until within recent memory has the stomach tube been used for purposes of diagnosis and for treatment. The stomach tube in connection with a syringe was first employed by Philip Syng Physick,[1] in Philadelphia, as early as 1800, and came into common use there in the first decade of the last century; but it was regarded as a valuable implement for washing out the stomach in cases of poisoning merely. It was truly a pump for many years, so that not until the siphonage[2] principle was applied to it in our own time was its great value for diagnostic and therapeutic purposes revealed. So the stomach tube became and remains a weapon of first importance in dealing with gastric disorders, and not least in ascertaining the extent and gravity of pyloric obstruction.

The most common immediate sequel of pyloric ob-

[1] "The Discovery and first use of the Stomach Tube by an American Physician," Julius Friedenwald, in Johns Hopkins Hospital Bulletin, September, 1903.

[2] "The stomach siphon was first proposed by Arnott, in 1829, but passed into oblivion. Kussmaul again directed the attention of the profession to the stomach tube in his publications in 1867 and 1869." C. A. Ewald in "Diseases of the Stomach."

struction is dilatation of the stomach with its resulting symptoms. The diagnosis of this condition, the estimate of its gravity, and the application of appropriate treatment are subjects on which the last word has not yet been spoken. So long ago as 1869, in his discussion of this topic, Kussmaul pointed out how frequently the difficulty was a purely mechanical one which surgery alone could remedy, and added the fear that his suggestion "would meet with quiet or outspoken scorn." And more than twelve years ago Ewald wrote how his experience led him inevitably to the conclusion that "operative gastric surgery has a great future before it, and perchance the time is not far distant when we will excise a lancet or leaf-shaped piece from a dilated stomach."[1]

In spite of the long ago conviction of these experienced clinicians, their advice came slowly to fruitage because the teachers of internal medicine had a theoretical rather than a practical knowledge of surgical possibilities, and because only recently have surgeons made an independent advance upon this field, having overcome the difficulties of the pelvis, the lower portion of the abdomen, and, to a degree, the problems of the bile passages.

However, to Kussmaul, to Ewald, and to such others we owe it that for many years the nature of gastric pathological processes has been known, and logical remedies applied, so far as might be done without resort to surgery. As Ewald says, without the stomach tube we should be almost powerless. Through its means he has been able fully to substantiate the state-

[1] C. A. Ewald, American edition, 1892, p. 158.

ment of Tiedeman and Gmelin (1826) that there is normally no hydrochloric acid in the stomach when fasting; a standard of the normal processes of digestion has been found, and to this the ability of the diseased stomach to assimilate food can be referred. Lavage as a therapeutic measure is carried out with the aid of the stomach tube, and by it an easy way is furnished to distend the stomach with air or fluids in order to demonstrate its capacity and position.

Just what we mean by gastric dilatation is not always easy to determine, for stomachs vary normally in capacity according to the size of the individual, and even in different individuals of the same general proportions. Says Ewald, "I understand dilatation of the stomach or gastrictasia to be that condition of the viscus which is accompanied by the clinical symptoms of disturbed gastric function due to the enlargement of the organ; and megastria to be the acquired or congenital large stomach, the abnormal anatomical state of which is functionally compensated." To quote further, "The large stomach may become catarrhal and its owner dyspeptic; but clinically speaking such a patient has no gastrictasia although more disposed thereto than others. Megastria and gastrictasia have frequently been confounded with each other. An entirely different condition, if I may anticipate, is *gastric insufficiency*, which indeed may and frequently does lead to the symptoms of gastrictasia, yet does not have the anatomical basis of the dilated stomach, but is a functional disturbance occurring in the most varied conditions of size of the organ."

In this discussion we are not considering acute dila-

tation, a rare and transient affection when survived, but rather that more common chronic dilatation familiar to all clinicians.

Pyloric obstruction is probably the most common cause of gastrectasis; the second assigned cause being absolute or relative weakness of the expulsive forces. To this latter variety belong the cases of so-called atonic dilatation of the stomach, in which the extent of the dilatation averages much less than when due to pyloric obstruction.[1] The increasing light which we are getting on this subject, thanks to recent and frequent operative exploration of stomach lesions, is strengthening our conviction that these atonic dilatations are less common than was at one time supposed, for very often adhesions, duodenal, hepatic, and omental, which account for the symptoms, are found; and these adhesions were not and could not be recognized before exploration. The scars of small, completely healed ulcers too have been found in cases when in life, or before operation, a non-anatomical cause had been diagnosticated. When undoubted cases of atonic dilatation are encountered, they are probably best treated medically; at least such treatment should be given a fair trial.[2]

Although the diagnosis of pyloric obstruction is not always easy, it is certainly to Ewald and Boas that we owe most for our accuracy and finality in the demonstration of this condition. As will be shown, however, from the Massachusetts General Hospital cases to be described later, it is by no means true, as Ewald states,

[1] W. H. Welch, Pepper's "System of Medicine," Vol. II, p. 587.

[2] Hartman in *Gazette Médicale de Paris*, Nov. 15, 1902, p. 361.

that as a rule patients with dilatation of the stomach are middle-aged or advanced in years.

If we are to apply the appropriate remedy certainly, it is essential always that we ascertain the cause of dilatation, — which, after all, is a secondary condition. As Ewald most pertinently says, "functional dilatations are always of relatively short duration, so that they do not lead at all to the classical symptoms of dilatation of the stomach, or only do so transiently; they run the course rather of dyspeptic conditions peculiar to the special underlying disease of the organ, chronic gastritis, atony, or the neuroses." [1]

As has been intimated, our present conception of the mechanical causes of dilatation is much what it was when Oppolzer wrote, but of the relative frequency of those causes we know much more.

Quite recently there occurred in the practice of the writers a case illustrating the difficulty of ascertaining the conditions present. The patient was a hard-working mother of many children; forty-six years old, thin and wiry; of previously good health so far as she could recall. Her illness had lasted about three months. She had much distress and pain in the left hypochondrium and epigastrium, nausea and vomiting after all food, — even water; she wasted rapidly, and for two weeks before being admitted to the Massachusetts General Hospital was kept alive by nutrient enemata. Distention of the stomach with air showed that the lower border descended only to the navel; there was no ptosis; the organ could contain but fifty fluid ounces of water. Both free hydrochloric acid and lactic acid

[1] Ewald, p. 122.

were present, but no organisms; and the residuum was about ten ounces. Our supposition was that some pyloric obstruction, either malignant or benign, was present. Accordingly the abdomen was explored. A very slightly dilated stomach was found, but the colon and duodenum were seen to be closely adherent to that viscus, while the pyloric orifice would readily admit the finger tip. The markedly thickened scar of an old pyloric ulcer was the obvious primary cause of the difficulty, but this would have given rise to few symptoms had it not been for the position of the duodenum, closely adherent to the stomach, so that the pyloric channel was sharply kinked at an acute angle. With the increasing dilatation of the stomach this angle became sharper and the lumen narrower, causing almost total obstruction. Freeing the adhesions and a liberal enlargement of the canal by Finney's method accomplished a cure.

This case is cited to illustrate merely the frequent difficulty and obscurity of diagnosis in certain cases of dilatation. Let us now return to a consideration of the causes and diagnosis of pyloric obstruction and allied conditions associated with gastrectasis.

Since the publication of Welch's well-known article, twenty years ago, when he stated that cancer was the most common cause of pyloric stenosis, the conviction gradually has been forced upon us that cancer, though very common in this region, probably does not cause a majority of these obstructions. The available figures seem to indicate that ulcer, with its sequelæ, cicatrices and perigastric adhesions, plays perhaps the most important rôle. In addition to the two above-mentioned causes of obstruction, cancer and ulcer, Osler[1] points

[1] Osler, "Practice of Medicine," p. 494, ed. 1901.

out that it is not an uncommon experience to find at autopsy instances of dilatation associated with simple hypertrophy of the coats of the stomach in the pyloric region; and Boas has dealt with the subject, citing operative cures,[1] as have a few others. Further, a case observed by the present writers — gall-stones, associated with marked gastric hyperacidity — was further complicated by a resulting simple pyloric hypertrophy with dilatation; and in this case, as in other similar cases, the removal of the gall-stones resulted in complete relief of the gastric conditions. The possibility of such complications has been dealt with by Kaufmann in a suggestive paper and will be again considered by us.[2] Another not infrequent cause of pyloric obstruction is the pressure of tumors from without, among which Ewald, Barker, and others have referred to floating kidney, though it must be said that the cases produced as evidence do not bear critical examination. Then there are the rare cases of polypoid growths choking the pylorus; and most interesting is the complete obstruction, with volvulus and strangulation, demonstrated on the cadaver as possible by Kussmaul, and quoted by Welch.[3] Seven cases of this catastrophe are described by Spivak.[4]

Welch furnishes a list of twelve causes of gastrectasis, under three groups: (*a*) stenosis of the pylorus or of the duodenum, (*b*) abnormalities of the contents of the

[1] Boas, Archiv für Verdauungskrankheiten, Bd. 4, § I.

[2] J. Kaufmann, "Gall-stones and Gastric Hyperacidity," *American Medicine*, Nov. 14, 1903.

[3] Pepper's "System," Vol. II, p. 588.

[4] C. D. Spivak, "Volvulus of the Stomach," *American Medicine*, Oct. 31, 1903.

stomach, (*c*) impairment of the muscular force of the stomach. We have to deal mainly with group (*a*), though group (*c*) may enter into the surgeon's calculations.

In considering the *symptoms* of pyloric obstruction, we must bear in mind that the gastric dilatation which eventually accompanies and follows it is often a late manifestation; but until dilatation takes place it is rarely possible to arrive surely at the true cause of the symptoms, namely, the obstruction. It is a common thing to find that those patients in whom gastrectasis is developed have complained of a disordered digestion for "years," "since childhood," for "as long as they can remember"; and these long-continued symptoms are seldom of a trifling or transient nature; they have responded sometimes quickly, at other times very slowly, to the ordinary methods of treatment; and they have recurred at increasingly frequent intervals. For years the patient has had "spells" of distress, sometimes after taking food, sometimes relieved by food. He has had sour eructations, belching of evil-smelling gas, occasionally vomiting of food or of a watery sour fluid, sometimes with pain preceding the vomiting. Rarely there has been blood or chocolate-colored fluid in the vomitus; more rarely he has observed that the stools are tarry. These "spells" have come and gone for years. They have been relieved by dieting and by drugs; they have recurred, at longer or shorter intervals; sometimes there is complete relief from discomfort in the interim, sometimes there is a constant sense of dull epigastric distress, necessitating careful dieting, often leading to abandonment of hard work, and even compelling a semi-invalid life.

The family physician watches and tends these cases at intervals for years; he regulates the diet, he prescribes antacids, anti-fermentatives, stomachics, saline and other laxatives, as the case may seem to demand. At times he practises lavage with benefit, and finally he sends the patient to the specialist or the general hospital, with the message that he has tried everything and nothing does any permanent good.

Perhaps by this time the sufferer has entered upon the later stage, dilatation, with occasionally an associated gastroptosis. If so, a further and more distressing chain of symptoms is established. The "spells" are more frequent or have become constantly present. The patient has grown languid, weak, and emaciated. He has lost twenty, fifty, or even a hundred pounds in weight. He is fretful, irascible, anxious; and is called by the thoughtless a hopeless neurasthenic. He is tormented by a constant unquenchable thirst. He has abandoned almost all solid food, but whatever he eats is taken with dread. Two or three hours after his insufficient and spiritless meals he has a return of pain in the pit of the stomach; and then he vomits, — sometimes involuntarily, sometimes by his own will. The act of vomiting may relieve the pain. Perhaps he vomits but once in the twenty-four hours and then in the small hours of morning. The vomitus is very foul. It may consist of the food recently eaten only, but occasionally he recognizes some old friend ingested two or three days before. The amount may be enormous, — from a pint to a gallon even, he will tell you. Gradually, after vomiting, the pain and distress abate, and the wretched victim subsides into sleep, awaking

next day to begin again the dreary round. He is annoyed, too, by an obstinate chronic constipation; the urine is passed in small amounts; he is a martyr to insomnia and headache, and life seems scarcely worth the living.

When you come to examine such a patient, you will find often a fairly characteristic condition. He is pale and emaciated, though often well developed, with a dry skin and anxious expression. The skin of the abdomen is shrivelled and scaly; the upper part is flabby and soft; while from the navel down there is ballooned a full, elastic, uniform protuberance when the patient stands. The belly is nearly everywhere tympanitic; place your hands upon it and shake it, and you may elicit a distinct splashing sound. You will see often a feeble peristaltic movement as the laboring stomach attempts vainly to empty itself. Says Osler: "Too much stress cannot be laid on the importance of inspection. . . . Active peristalsis may be seen in the dilated organ, the wave passing from left to right. Occasionally antiperistalsis may be seen."

Let us pause for a moment and consider the problem presenting itself to the physician for solution. The description just given is the classic description of a patient suffering from a dilated stomach, and one need not go much farther in the way of investigation in order to make an absolute diagnosis of the condition. But happily such cases are becoming rarer, as a more enlightened treatment has come to pass. And just as the immense ovarian tumor, the *magnum opus* of the pioneers of abdominal surgery, is now seldom seen, so the great dilated stomach, though still observed, is less common than it was.

We must not be content to recognize a *fully* dilated stomach ; we must recognize dilatation *early* if we would save our patients from months, if not years, of invalidism; and we must restore them to health, or hold the disease indefinitely in abeyance.

As we have indicated, a dilated stomach is a secondary and not a primary condition. The condition is an abnormally large stomach, in which there is a motor insufficiency. The motor insufficiency is the more important condition,—it is the first condition; later comes the weakening and distention of the gastric walls. This is the usual course of events, but there is a notable exception, as is to be expected of all things medical. The patient may have been a large eater of coarse foods, or a consumer of large quantities of liquids — malt or some others. In the course of time the stomach has become enlarged to accommodate the daily distending ingesta, — this is the condition of "megalogastria," — and this large stomach may continue indefinitely with good motor sufficiency. But such a patient, falling on evil days that diminish his bodily vigor, so that the walls of his stomach no longer act with their wonted force, — finds that the food stagnates and ferments, and then quickly we have a condition which, when seen, must be recognized as none other than one of gastric dilatation.

The special point to be remembered is, that there may be found in the course of examination a mighty stomach, without motor insufficiency, and that this is not what is known technically as a dilated stomach.

Motor insufficiency may be of two kinds: there may be weakened power in the stomach muscles to contract and force the food along, so that from sheer loss of

muscular tone the food is allowed to stand and stagnate; or there may be an *excess* of power developed in the muscular wall of the stomach, — but even this hypertrophy is not able to overcome the obstacle which has developed at the pylorus, and so the food stays and ferments, with a gradually resulting dilatation.

Thus, we have dilatation in the one case following loss of motor power in the stomach, and this brought about by weakening of the stomach walls, or an atonic condition; and in the other case by a mechanical obstruction to the outgo of food from the stomach. Such an obstruction may be due to the cicatricial contractions due to ulcer at the pylorus or in the duodenum, to pressure or to inflammatory bands on the outside, to cancer, and possibly to kinks at the pylorus, — due to prolapse of the stomach (gastroptosis), while in children there may be a congenital stenosis. Of the mechanical conditions causing dilatation, many demand surgical treatment and will be benefited; others had best be let alone; but the discussion of these propositions will be taken up in detail in other chapters.

How shall the diagnosis of motor insufficiency be made early? By a careful study of each case. Certain groups of cases are specially easy to study, for example, working-men in whom there is little of the nervous element. The fact that they seek treatment is *prima facie* evidence that something definite is the matter. In men prolapse of the stomach is rarer than in women, and simple atony less common. On the other hand, alcoholic gastritis and consequent atony are more common in men than in women; but on the whole, the

elimination of nervous phenomena makes the arrival at a correct diagnosis more easy.

Having obtained such information as is possible from the history of the patient, and from inspection and palpation, the next thing to consider is, what can be learned from a test breakfast. In such test we must not forget that excitement, overwork, and fatigue may enter into the problem and cause motor insufficiency, so that we may find it advisable to repeat our experiments on different days to secure control observations.

If impaired motor function is really suspected, from the history, it is legitimate to begin at once by washing the stomach early in the morning, when a full meal has been taken the night before. By this means one may ascertain whether a residuum of any considerable size is present. Any remains of food in the morning show stasis. The removal of simple, clear fluid without food means hypersecretion, and may have nothing to do with stasis. In this latter event, one can at the same time determine by inflation of the stomach whether it is enlarged or not — as well as its position in the abdomen.

The stomach, having been cleared, is ready for the test breakfast, which is removed at the end of an hour.

Meanwhile the fluid and food removed at the first introduction of the tube are examined for lactic acid as well as for free hydrochloric acid.

The test breakfast having been withdrawn, it is examined later qualitatively and quantitatively for hydrochloric acid, and a test is made for lactic acid.

Lactic acid and a normal or increased amount of hydrochloric acid are not found in conjunction, hence the presence of lactic acid with an absence or very small

amount of hydrochloric acid points distinctly to atony or cancer as the cause of the stasis. On the other hand, a well-marked hydrochloric acid contents, with fermentation, points to ulcer as the probable exciting cause of the stasis.

In case stasis has not been suspected, and the test breakfast being given and withdrawn, a greater amount of stomach contents is expressed than was given, stasis must be assumed. In such case, of course, the quantitative examination for hydrochloric acid is useless for comparison; but, in so far as it tells whether there is much or little hydrochloric acid in a given amount of the specimen, it may be an important fact.

We may suspect stasis, yet find the stomach empty when the tube is passed in the morning. In this case we shall have to administer a Leube test meal and remove what remains, if any, at the end of about seven hours. There should be no residue in the normal stomach after that interval; therefore, any residue now found points to motor insufficiency. The converse of this proposition is not constantly true. That is, no residue does not assure sufficiency.

In all cases in which stomach contents has been removed, you must let the aspirated contents stand long enough to allow an observation of what is taking place. When there is marked fermentation, three layers quickly appear in the fluid, — at the bottom the solid contents, more or less changed by the process of digestion, above that a clear, watery layer, and on top a frothy surface. Through the clear layer bubbles of gas are seen to rise and become entangled in the froth of the upper layer. With such a picture one is positive

that fermentation exists. There are, however, many cases in which partial stasis is suspected, but cannot be demonstrated by this crude though practical method of observation.

Another test is to be recommended here, — the fermentation test. A portion of the Ewald breakfast is put into a fermentation tube and the time when fermentation begins to take place is noted. Riegel states that this procedure has been a routine practice in his clinic for some time, and that thus a good deal of light has been thrown on many cases coming under his observation. Hewes has recently developed the technique, and has endeavored to find the limits of the onset of fermentation in presumably healthy stomachs, so that we may have data with which to compare the results observed in pathological conditions. A gain is made by the fermentation test because small amounts of retained and fermenting food may escape the stomach tube. Such retained food may cause symptoms, and if found, disclose the presence of stasis in a very early stage. These remnants, when added to a test breakfast, would, when removed, cause fermentation very much earlier than would the contents expressed from a normal stomach in which there were no such remnants. Such a fermenting contents, with a high percentage of hydrochloric acid, points to stasis following ulcer, for in many cases hyperchlorosis alone is merely an evidence of increased motor activity. A large amount of hydrochloric acid may be found combined with marked fermentation, but other than lactic acid fermentation. In the case of diminished hydrochloric acid no diagnosis can be made distinguishing an atonic condition from a

carcinomatous obstruction; so the differentiation must be sought along other lines of investigation.

The history of many cases seems to make it clear, even when there is well-marked mechanical obstruction, that a hypertrophy of the stomach wall takes place; and because of the hypertrophy, when the patient is taking a well-selected diet, the stomach is able to do such good work that he is enabled to lead a very satisfactory existence. There come times following improper food, or great bodily or mental fatigue, when the stomach's power of overcoming the obstruction breaks down; then symptoms of marked dilatation appear with astonishing rapidity. Sometimes this is a temporary breakdown only, yielding to treatment, but at other times it remains permanent. As in the case of broken compensation in valvular disease of the heart, one attack of acute dilatation may become compensated, but is, nevertheless, apt to be followed sooner or later by others.

If all the symptoms point to a mechanical obstruction of benign origin, the question of operative interference must be regarded as a possibility sooner or later.

As to that consideration, much depends at first upon the patient and his position in life — his ability and willingness to follow a careful diet and restricted work. The patient who cannot have proper care and food should be advised to have an operation performed and should be encouraged with the idea of receiving marked relief from all his sufferings.

In general the medical treatment of such cases consists in rest, in small amounts of easily digested food with little water taken at the meals, and in proper

lavage to secure physiological rest of the stomach and to induce a return of tone to the dilated walls.

In atonic conditions the treatment is wholly medical, excepting in those cases in which it seems necessary through operation to convert for the time being the stomach into a mere passage, so that the walls may regain their tone as far as possible. In many cases of gastrectasis the improvement under medical treatment, even when there is well-marked mechanical stasis, is remarkable. Under rest, diet, lavage, together with laxatives and tonics, the stomach regains its tone, the sense of weight and discomfort disappears, eructations cease, the bowels empty themselves, pain and vomiting are no longer experienced, weight is gained, and vigor returns. Even in those extreme cases in which the patients have been vomiting quarts at a time every few days, improvement may be extraordinary. The patient is frequently deceived and leaves the hospital or the care of his physician, thinking himself absolutely cured, and only too often we hear of him no more.

What, then, is his fate? Does he remain comfortable, or do the symptoms return? and even under intelligent care, what is the outcome of it all?

The writers have attempted to find an answer to these questions and in the following fashion: There are collected in the clinical index at the Massachusetts General Hospital one hundred and seventeen ancient cases tabulated as "Gastric Dilatation." The cases of recognized pyloric obstruction and dilatation from ulcer and cancer and other obvious causes are not in this list. It contains those cases only in which gastrectasis existed without ascertainable cause. In this list, too, atony was

frequently assumed to be present by the clinician. Other causes of dilatation were suspected, but in the absence of more definite signs no further positive diagnosis was made, and the cases, with very few exceptions, were treated "medically," as the phrase is. Let us then, for the sake of our own better information, make some study of these cases, of their treatment and outcome, which we have followed up so far as it was possible for us so to do, and see how far the results bear out our statements already made.

CHAPTER IV

THE STOMACH (*Continued*)

DILATATION TREATED WITHOUT OPERATION

We purpose in this chapter to tell of sixty cases of gastrectasis treated in the medical wards of the Massachusetts General Hospital in the years 1888–1903, and of the end-results which it has been possible to obtain. In the list those cases are not included in which definite diagnoses of organic disease were made. Such cases will be considered in their appropriate chapters.

The cases described here were of chronic dyspeptics who had suffered anywhere from a year to a lifetime and were admitted to the hospital wards for treatment. They are listed in the hospital under "Dilatation of the Stomach," because no more accurate diagnoses were made. Why, in the light of subsequent investigations, some of these cases were not more carefully analyzed it is hard to see.

There are recognized by clinicians a male and a female type of dilatation; the male type is more likely to be a great lateral dilatation, discovered by tympany above the umbilicus, extending beneath the ribs upon the left and pushing up the diaphragm. This type is frequently seen among alcoholics in dispensary practice, and is usually treated successfully in out-patient departments. It is not to this alcoholic type that we refer; indeed, of

the forty-one male cases to be described, six only could in any sense be called alcoholics.

The female type of dilatation is the long stomach distended toward the pubes, usually associated with gastroptosis, though a prolapsed stomach is not necessarily always dilated. We used to regard many of these cases as atonic, and doubtless many of them are so; but, in the experience of the Massachusetts General Hospital, the majority of atonic cases, if curable or susceptible of relief, find their benefit in the out-patient department and are not met with in the hospital wards.

There were listed in the index catalogue of the hospital, in the last fifteen years, one hundred and seventeen cases of "Dilatation of the Stomach." We have traced sixty of those cases, a little more than 50 per cent; of the fifty-seven untraced cases it is probable that many are dead. Certainly dead men are less easily discovered than the living.

A passing word about those fifty-seven lost cases. We have a record of their condition when they left the hospital: one was "well"; sixteen were "much improved"; twenty-seven were "improved"; eight were "slightly improved"; five were "not improved."

Of these fifty-seven cases, forty-two were males and fifteen were females. The average age of the males was 46.5 years, the average age of the females 42.6 years; not that there is any special interest or significance in these figures, except that they will be found to correspond later with those of the patients who have been traced.

The records show that when those cases which could be traced left the hospital, two were well, two unim-

proved, and forty-seven improved; nine died in the hospital. At the time of our investigation the report is as follows: —

In sixty cases traced; end-results: well, seven; unimproved, nineteen; improved, five; dead, twenty-nine.

This is not an encouraging showing; let us consider, however, some of the facts and figures in detail, and learn what we may of this interesting but unclassified group.

In the first place, it is striking that of the sixty cases, forty-one were *male* and nineteen were *female;* while at the same time the hospital records show that during that period of fifteen years the total female entries of all classes of cases somewhat exceeded the male entries. The explanation for the reversal of figures in the cases under consideration probably lies in the fact that the majority of women with stomach disease who entered the hospital were found to have clear histories of gastric ulcer, and were listed under that heading.

The *ages* of the men varied greatly; the youngest was twenty-seven, the eldest was sixty-four, and the average age was forty-seven years. The youngest woman who entered was twenty-two years, the eldest was sixty-nine, an average being 40.3. These figures correspond closely with those usually given, and when we come to study diagnoses it will appear that cancer was less commonly seen among the women than among the men when the patients were admitted.

The *duration of symptoms* in both sexes varied all the way from twelve months to forty years.

As one would expect, the *loss of weight* varied greatly, though the records do not always state the exact figures.

The variation, however, runs from zero up to a loss of one hundred pounds, and seems to be of no special value in throwing light on a more refined diagnosis.

Pain was an almost constant symptom in these sixty cases; five only of the patients were without it. It is variously described as coming on immediately after eating, several hours after eating, relieved by eating to return later, and many times as being constantly present. As one would expect, when there was pyloric obstruction, *late* pain was much the most common. It is described as a burning, gnawing, throbbing, dull, and boring pain; and many persons are found in the class who complained of constant pain. In all the cases it appears that the pain was relieved by vomiting.

Vomiting was present in fifty-seven of the sixty cases. Two of the cases stated that they vomited in the absence of pain, but in no case were both pain and vomiting absent. The vomitus varied, of course, in amount; and one reads of belchings, spittings up, vomiting the last meal taken, or vomiting enormous amounts typical of cases of great dilatation.

Fifteen, or a quarter of the sixty cases, gave a history which might suggest that there had been at some time a distinct *hemorrhage* from the stomach; only three, however, gave a clear history of frequent vomiting of blood. One case also passed stools suggestive of gastric or duodenal ulcer. A consideration of this one symptom of hemorrhage alone shows that a considerable number of these cases would undoubtedly to-day be analyzed further, and put into the group of cases in which the dilatation was due either to ulcer or malignant disease.

The *analyses* of gastric contents as given in the records are not satisfactory. Indeed, one would scarcely expect satisfactory accounts, from our present point of view, in cases running back ten or fifteen years. As we come down toward the present date, however, the analyses are found more accurate, but apparently no more final for the establishment of diagnosis. This criticism of the records is equally true of all manner of cases recorded in former years, and the fact that in all departments of clinical research our present observations are better than those former ones indicates merely that we know more than we used to know. The signs "splashing" and "visible peristalsis" are seldom recorded in the early records, although they must have existed. Their significance was apparently disregarded or overlooked.

The *treatment* of all these cases need not be entered into at length; it was what the physical examination and analyses obviously suggested. The patients were put to bed, and lavage was employed commonly, being used in forty-four out of the sixty cases. Most of the individuals were given such tonics as nux vomica, capsicum, light wines, strychnine, and iron. In suitable cases a full diet was employed, in others a dry nitrogenous diet, and in others still a liquid diet. It is interesting to note that of all the sixty cases five only were given HCl regularly, and two only were fed upon nutrient enemata.

In all these cases cathartics were employed, — such as Carlsbad salts, aloes, strychnine, belladonna, cascara.

Such, in very brief outline, is a summary of our notes upon the sixty cases as a whole. Let us now consider in more detail those cases which died or recovered,

and see if in any way such facts as we have are significant.

Seven cases *recovered*, and after several years report themselves as well; two of them are women, five are men. The first and most striking thing about all these is that the recoveries took place in persons in middle life who had been many years dyspeptics, — their periods of invalidism running from five to forty years individually, an important fact for the consideration of those enthusiasts who are urging immediate operation on all cases of chronic dyspepsia.

The *dead:* of the sixty cases, twenty-nine (48.3 per cent) are reported dead, and the causes of this large number of deaths are the subject of serious importance in this inquiry. We are constantly being told, and with reason, that the greatest danger of long-continued stomach disease, after early life, is cancer, — the probability of malignant disease developing on the site of ulcer. After careful inquiry, it appears that in fifteen, or over 50 per cent, of these twenty-nine deaths, cancer was assigned as the cause of death. Our figures are suggestive either way, but prove nothing either way. Of the fifteen deaths from cancer, six followed a history of many years' invalidism. These six patients had had stomach symptoms for five, seven, nine, ten, twelve, twenty, and "many" years; they sought relief at the hospital as a last resort, and most of them died a few months after their entrance. The probability, of course, is that the above-stated contention is sound, and that in these cases cancer had been implanted upon long-standing non-malignant disease.

In the remaining nine cases of death from cancer,

the disease ran a short course from the initial symptoms to the end, the average duration being seventeen months. The shortest case is recorded as four months in all, and the longest as thirty-nine months. These figures dealing with the duration of cancer correspond fairly well with those of von Mikulicz, Moynihan, and other writers.

The causes of death in the remaining fourteen persons, of whom cancer is not reported, are "starvation"; although for a certain proportion one *suspects* cancer, the presence of which was not disproved, from lack of autopsy.

For the cancer cases one final note is interesting; namely, that with two exceptions all died within nine months after leaving the hospital, no matter what the duration of the disease may have been before entrance. The two exceptions must have developed their cancers after they left the hospital, for their deaths are recorded in three years and five years subsequent to the date of hospital discharge.

Of the fourteen cases against whom the diagnosis of cancer cannot be written, eleven died within a year after leaving the hospital. Lack of proper returns and autopsy records leaves us without definite conclusions in regard to these cases, but we must assume that with many of them cancer was the cause of death. Eleven of these cases were of short duration after their discharge and had been ill previously for periods varying from four months to twenty-three years.

Three of the non-malignant cases lived six, five, and six years after their discharge, and died eventually of "stomach trouble."

To put our facts in other words: of the *twenty-nine* fatal cases, twenty were *short cases*, ill but a few months before entering the hospital and dead a few months after leaving. Nine were *long* cases; and of the *long* cases four died of cancer soon after coming under observation; two died of cancer several years after being studied at the Hospital; and three died of wasting gastric disease other than cancer.

The figures may be juggled in many another interesting fashion, but nothing is proved beyond the first obvious fact, that nearly 50 per cent of these cases of gastrectasis died, and that about half the deaths were due to cancer. These cases speak eloquently as to the difficulties to be encountered of making a full and accurate diagnosis even in hospital work.

Nineteen of our cases have been found worse or *unimproved* since leaving the hospital, and many of them are so seriously ill that we must expect them shortly to be ranked with the dead; eleven of them are men and nine of them are women. Their ages are unimportant, but we may note that they averaged at entrance forty-three years, the youngest being a man of twenty-eight, and the eldest a man of sixty-four. And the duration of their invalidism varies all the way from one year to twenty-eight years, the average being 10.7 years. Most of them, however, give histories of long-continued dyspepsia, either before entering or since leaving the hospital, so that it is fair to state that in very few, if any, of these cases are we at present dealing with malignant disease. The essential symptoms have been epigastric pain after eating, which is present in all of the nineteen, and occasional vomit-

ing, which is present *in seventeen of the nineteen.* The symptom of ancient hemorrhage has been present in but six of the cases, and such hemorrhages were so long ago recorded that a positive diagnosis of gastric ulcer cannot very well be made. The presence or absence of HCl in these cases is interesting. It was present in sixteen of the cases and persistently absent in three; yet those three cases obviously had no cancer, for they have continued living on feebly for nine and ten years since leaving the hospital, — indeed, one of them has been an invalid fifteen years, the second thirty-three years, and the third thirty-four years. In all of the nineteen unimproved cases there was greatly delayed motility with a gastric capacity considerably increased. They have gone on living many years since leaving the hospital, but all are hopeless invalids, dependent on others for their support. It is a depressing series of biographies.

Five cases of our sixty are reported as "*improved.*" Though not to be placed in the class "well," they approximate that class, and may be considered in the same connection. Two are females and three are males, and their ages vary widely, the youngest being a woman of twenty-two, the eldest being a woman of fifty-four, at entrance.

Taking these five cases in some detail, we note: —

Case 1. Was fifty-four years old at her entrance, fifteen years ago, and is now fairly comfortable at the age of sixty-nine. She had been ill twenty-one years when first seen at the hospital, so that now, in her old age, she has been a dyspeptic for thirty-six years. Her symptoms have been occasional epigastric pain after

eating, and occasional vomiting. It is recorded that some twenty years ago she vomited blood twice, and the presumption is that she has a slight pyloric obstruction due to a healed ulcer. At the Hospital the stomach contents contained free HCl. She was treated by lavage, cathartics, tonics, and nutrient enemata, and be it noted that this case and the next are the only ones in our list of sixty of whom it is recorded that they were treated by nutrient enemata. This patient continues the use of the stomach tube at home and enjoys a fairly comfortable existence, — a good example of what may be expected in moderate stenosis of the pylorus under fairly favorable circumstances.

Case 2. Was a man thirty-nine years old who had been acutely dyspeptic for one year. He too had had and has epigastric pain, occasional vomiting, and has a record of one hemorrhage about nine years ago, before entrance, and he too doubtless has a slight pyloric obstruction due to a healed ulcer. No free HCl was found present; there was abdominal splashing, and he was treated by lavage, was given HCl, and fed by nutrient enemata. He reports himself as fairly comfortable.

Case 3. Was a young woman of twenty-two who had been a dyspeptic for eighteen months, with epigastric pain several hours after eating and occasional attacks of vomiting. At one time, shortly before entrance, she vomited blood; HCl was present; she was treated by lavage, was discharged after two weeks, and reports herself as fairly comfortable so long as she uses the stomach tube.

Case 4. Was a man of thirty-nine who had had symptoms for twelve years. Now, fourteen years since his

discharge, he looks back on twenty-six years of dyspepsia. He is thin, — twenty pounds below his normal, — with occasional attacks of pain and vomiting; HCl was present in his case; he was treated and continues to treat himself by lavage.

Case 5. A man of fifty-two at entrance, had symptoms of comparatively short duration, — three years before entrance and two years since. He has lost thirty pounds in weight and has the usual symptoms of occasional pain after eating and occasional vomiting; HCl was present in his case; and he continues fairly comfortable with the use of lavage.

All of the above five cases had dilatation of moderate extent with a gastric capacity ranging from forty to eighty ounces, and delayed motility; indeed, except for the disparity in age, they seem quite similar.

The lesson, apparently, to be drawn from this is that patients with mild degrees of dyspepsia, in whom there are healed ulcers with some pyloric obstruction, may be kept fairly comfortable by the continued use of lavage, which prevents accumulations and consequent fermentation, but cannot be made completely well while the obstruction, mechanical or functional, with its consequent dilatation and malnutrition, persists. However, we must not forget that such an existence to many persons is preferable to the thought of undergoing an operation.

The *well:* As with the class of "improved," the "well" occupy but a small space in our list. Seven persons out of sixty report themselves well. When we come to study the figures we find little that is significant. The ages of the patients on entrance varied from twenty-nine to fifty-seven; five of them were men, two

were women; and while the two women had been ill twenty and fifteen years respectively, the men had been ill for from six months to forty years; in no case was there a striking loss of weight, except in that of a man of forty-two who had lost forty pounds. In brief detail the records are as follows: —

Case 1. Was a man of fifty-seven, who had been ill forty years and lost five pounds; he was a carpenter and there was some suspicion of lead colic about him; during this long period he had had frequent attacks of gnawing epigastric pain relieved by food; sometimes vomiting would relieve the pain, and he had vomited as much as two quarts at a time; he was constipated and flatulent; he was thin and neurotic. The lower border of his stomach was four inches below the umbilicus, there was a residue of eight ounces, thin undigested food, not foul; there was abundance of free HCl and no lactic acid. The man was put on a dry nitrogenous diet with bicarbonate of soda, iron, and gentian; after six weeks he was discharged well. For the past nine years he has remained well.

Case 2. Was that of a man very different from the last; he was thirty-five years old and had had symptoms for three years only. At the hospital they thought he might have cancer, but that was eleven years ago and he is still living. For three years he had debility, poor appetite, and epigastric pain coming on half an hour after food. He was an emaciated man, and there was abdominal splashing. At the hospital they fed him up and gave him HCl. His stomach was dilated to the umbilicus. In two weeks he went home "well." He has been well ever since.

Case 3. Was a good deal more serious; it was that of a man forty-two years old, whose stomach reached three inches below the umbilicus, with a capacity of sixty ounces; HCl was present and no lactic acid. For many years he had had occasional vomiting of about fifty ounces at a time. He had lost forty pounds. At the hospital they washed him out and fed him up, and at the end of two weeks he went home, taking with him a stomach tube, since unused. That was six years ago, and he has been well ever since.

Case 4. Was that of an emaciated middle-aged man, who had been vomiting occasionally for ten years, and usually at midnight; he used quite frequently to have pain after food, there was some ptosis of the stomach, and the dilatation extended four inches below the umbilicus. A residuum of five ounces was expressed and much free HCl was present, as well as butyric and lactic acids.

It is evident, from the tone of the record, that this was regarded as a rather ugly case; but they gave him Carlsbad salts, washed his stomach out, sent him home with a tube, and he has been well ever since. That was four years ago.

Case 5. Also looked unpromising; it was that of a man forty-four years old, who had epigastric burning and dull aching two or three hours after food for many years. He had lost twelve pounds. The pain was evidently relieved by food, but came on again later, and often he used to vomit up a pint or more. He had ptosis of the stomach, too, and splashing, with the greater curvature two inches below the umbilicus. His gastric capacity was fifty-three ounces, and free HCl was present.

They gave him a milk diet, salts, bismuth, and bicarbonate of soda, with daily lavage. He went home well, and is well to-day after four years.

Case 6. Was that of a young woman twenty-nine years old, who had been a dyspeptic for twenty years, and had vomited mucus and food at varying intervals during that period. There had never been any significant pain, but she was emaciated, with a stomach four inches below the umbilicus; without HCl and with lactic acid present.

She was put on a full diet, after three days of which HCl was found. After three days of such treatment, and with lavage, she left the hospital with a stomach tube and slightly relieved.

Here is a quotation from her letter written twelve years after leaving the Hospital. It is instructive and somewhat entertaining. "All of the symptoms returned after leaving the hospital, and for three or four years I was very ill indeed and finally was persuaded to go to Dr. F——; after treating me for about ten months, he succeeded in curing me almost entirely. I gained in that time about twenty pounds and have gained almost steadily since [*sic*, for eight years!].

"Dr. F—— does not believe in washing the stomach. I am sure that the thing which did me the most good was teaching me how to live. I can now eat almost anything and, unless I am indiscreet, rarely have return of the old trouble."

Case 7. Was that of a widow of thirty-eight, with a history of fifteen years of dyspepsia. The record notes the fact that she was a neurasthenic with a slightly dilated stomach. During these fifteen years she had

had occasional attacks of vomiting, but no hæmatemesis; she was constipated, thin, and excitable; she spent three weeks in the hospital being fed up, and being given tonics. Then she was discharged "relieved." A month later she reëntered the hospital, to stay there two months under the same treatment, and was then discharged well. She had no gastric lavage.

Eleven years have elapsed and she reports herself in excellent health.

Of these seven persons who recovered and have remained well there is nothing especially in the history to distinguish them from the persons who died or the persons who continue dyspeptics. All appeared unfavorable cases for treatment; none of the seven had hemorrhages; six had vomiting, and in every case there was either vomiting or pain or both; each one had a dilated stomach. They are shining examples of what may be done "medically" with unpromising cases.

In this "well" class, again, the investigation of gastric contents determined nothing except that delayed motility was shown; four cases had HCl, three of them had it not; two of the cases showed lactic acid, and five of them showed none; four of the cases, those with most dilatation, were treated by lavage; three of them, those with slight dilatation and of the neurasthenic type, were not so treated. All of the cases were in middle age or just about entering upon that period of life; and all of them are living still, well advanced in middle age or old age.

Just what may be the causes of dilatation in these "well" cases is not apparent, but certain it is that they have been fortunate enough to pass through long periods

of gastric disease without developing cancer and that they are now well, — these seven out of sixty.

In resumé we may say, as we have already stated, that we have been considering a series of cases in which the diagnosis was made of a prominent symptom which has several important etiological causes. For one reason or other, best known to the clinicians under whose eyes these cases came during the past fifteen years, no success was attained in separating these cases into their etiological groups for diagnostic purposes. This is not surprising when we remember the general disfavor with which dyspeptics have been treated in years past — they have received scant attention in too many instances. In the light of our present knowledge and with the present enthusiasm for stomach work, it seems more than probable that this diagnosis — gastrectasis — would not be the only one made to-day in many of our cases. The series shows distinctly that a goodly number would be regarded as cases of mechanical obstruction, probably of benign origin. The difficulties in the way of diagnosis are illustrated by the resulting cures in some of the most unfavorable cases, and in the rapidly following deaths in others presenting the mildest symptoms, as well as symptoms of the shortest duration. It must, however, be held firmly in mind that while many of our present diagnostic procedures have been known for years past, their complete application in a practical logical manner has been a matter of a few years' standing only. The surgeon who is given to criticising medical diagnosis and treatment should remember also that he must be as lenient in his judgment of past medical diagnosis and treatment as he wishes

internists to be when he asks them to blot out from their remembrance the statistics of all gastric surgery done before the year 1904. Certainly a number of the above cases of dilatation would apparently have been benefited by an operation for the relief of the mechanical obstructions which evidently gave rise to the symptoms; and the point to be insisted upon is that, after all possible attempts have been made to reach a clear understanding of the causes of gastrectasis, and after the adoption of suitable "medical" measures without beneficial results, then operative measures are to be considered and a surgical consultation called.

CHAPTER V

ULCER OF THE STOMACH AND DUODENUM

It is fair to state that of all lesions giving rise to digestive disorders, ulcer of the stomach and duodenum holds the first place. Probable as this proposition is, however, it seems impossible of demonstration; and by ulcer we mean ulcer and its sequelæ. There are various reasons for believing in the really conspicuous position of ulcer, and as surgical treatment of gastric lesions is opening to us more frequent opportunities of making inspections during life, surgeons are coming to feel that the old-time statistics of the frequency of ulcer are incorrect.

The commonly quoted figures among us on the subject are those of W. H. Welch,[1] who estimated that about 5 per cent of mankind suffer from gastric ulcer, and those figures were founded on the findings at autopsy of open or cicatrized ulcers.[2] Other writers have placed

[1] Pepper's "System of Medicine," 1885, Vol. II, p. 482.

[2] "Ulcer of the Stomach," by Franz Riegel, Nothnagel's "Encyclopedia of Practical Medicine," ed. 1903, p. 548: "The best way of estimating the frequency of gastric ulcer is to study autopsy statistics. According to Berthold, 262 cases of ulcer were found in the Pathologic Institute of the Berlin Charité in the fifteen years from 1868 to 1882; this means that ulcer or evidence of old ulcers was present in 2.7 per cent of all the cases that were examined post mortem in that Institute; of these cases 128 occurred in men and 134 in women.

"The figures obtained in the Munich Pathologic Institute are not so high. According to Nolte, ulcer was found in only 1.23 per cent of all

the percentage very much lower, as Lebert, who made it 0.64 per cent. Then there are the familiar tables collected by Greenough and Joslin,[1] showing that at the Massachusetts General Hospital in Boston the percentage was 1.043; at the Johns Hopkins Hospital, Baltimore, 0.32; at the Cook County Hospital, Chicago, 0.15, and at the Arapahoe County Hospital, Denver, 0.12. Writers go on to show that geography has a great deal to do with the matter, and Welch's records are usually the final ones named in this connection: 2.7 per cent

autopsies; of these 0.8 per cent were seen in men and 1.8 per cent in women. Griess, in Kiel, found ulcer in 8.3 per cent; Ziemssen, in Erlangen, in 4.55 per cent; Stoll, in Zurich, in 2.16 per cent; Stark, in Copenhagen, in as many as 13 per cent. Brinton states that 5 out of every 100 autopsies revealed the presence of gastric ulcer. Grünfeld found exceptionally high figures; he succeeded in demonstrating the presence of ulcer scars in 92 out of 450 autopsies (241 women and 209 men) — that is, in 20 per cent; of the 92 cases, 77 were found in women and 15 in men.

" Fiedler examined 2200 bodies, and found ulcers or cicatrices in 20 per cent of female bodies, and in 1.5 per cent of male bodies. The attempt has been made to explain these variations as due to certain regional differences; in part, however, they must be attributed to the different clinical material that enters different hospitals; I have called attention to this point in another place when discussing mortality statistics."

The Pathological Records of the Boston City Hospital, quoted by Sears, show that of 2127 autopsies done at that institution since 1896 there are but 29 ulcers of the stomach and duodenum recorded (1.3 per cent).

Howard reports that the clinical observations in all services at the Johns Hopkins Hospital in a period of fifteen years, 44,000 cases, show that ulcer of the stomach was recognized but 87 times (1 in 506 cases).

At the Massachusetts General Hospital, since the opening of the new Out-patient Department, August 31, 1903, to March 22, 1905, 41,385 new patients were treated, and 10,845 of these were medical cases. The diagnosis ulcer of the stomach has been made but 54 times, and in this list are a number of cases in which the diagnosis of cancer was probable, as well as of old stenosis cases, and some of doubtful diagnosis.

[1] *American Journal of Medical Sciences*, August, 1899.

for Berlin, 1.23 per cent for Munich, 8.3 per cent for Kiel, 10 per cent for Jena, and 13 per cent for Copenhagen. Interesting as all these figures are, and great as is the diversity of conclusions drawn, it seems fair to state that the medical and autopsy records alone show 5 per cent of all men to suffer from gastric ulcer, and at the same time it is not unwarrantable to assert that the true percentage is probably higher.[1]

Such being the case, it is interesting to inquire under what conditions of symptomatology shall we conclude the presence of gastric ulcer. Those sixty cases of gastrectasis studied in Chapter IV suggest strongly that ulcer is or has been present in great numbers of cases in which diagnoses could not definitely be made.[2]

The presence of a gastric ulcer does not mean necessarily pain and bloody vomiting, nor must we think of ulcers as being always of the same type. Here is a case in point.

A lady of forty-five consulted us some months ago, saying that she had had chronic dyspepsia for twenty years. For most of that time she bore it without much complaint and had not materially lost vigor, though she never felt very well; she used to have a little pain in

[1] M. C. Millet (*St. Paul Medical Journal*, 1903) observes, "If we take even the lowest percentage as found post mortem, viz. 1.50 per cent, we see that every other case is undiagnosed in life."

[2] "Latent ulcers are not uncommon; Savariaud gives their proportion as 20 per cent of all cases of gastric ulcer; . . . it is difficult to explain why some of these ulcers should exist without producing symptoms. . . . In the cases we have seen, the ulcer has been near the lesser curvature of the stomach, and this might possibly afford an explanation, since in this situation they would be brought less intimately into contact with food." "Surgical Treatment of Diseases of the Stomach," by Mayo Robson and Moynihan, 1901, p. 104.

the epigastrium whenever she ate solid food. She tried dieting in various ways without special benefit; she was never nauseated, and the pain usually subsided after two hours. She had gone the usual round of physicians, but had grown discouraged, and for the last four years had done the best she could for herself. In the past year her symptoms had become decidedly worse; all food, and even water, caused pain immediately it was taken; the pain was in the same old place and often radiated to the back and left shoulder blade; she had become afraid of food and had grown melancholy and almost suicidal.

All this was bad enough, and we must remember that it came after many years of increasing ill health, during which time she had been content to go about ranked among those whom we rather flippantly call chronic dyspeptics. Further details of the case are needless here, except to tell the result. The abdomen was opened, and there was found a broad cicatrix furrowing the anterior wall of the stomach; it was undoubtedly the result of long-standing ulcer, now healed, and the hour-glass constriction which it caused had the immediate effect of producing the distressing symptoms. The patient has been well since an operation for giving proper stomach drainage. We must conclude that the constant symptoms running over years should have suggested some anatomical lesion, and an operation should have been done long ago.

Such facts as the above are perfectly well known, but they are not perfectly well appreciated. Osler puts the familiar experience thus:[1] "The condition [ulcer] may be

[1] Osler, "Practice of Medicine," p. 481.

met with accidentally, post mortem. The first symptoms may be those of perforation. In other cases, again, for months and years, the patient has had dyspepsia and the ulcer may not have been suspected until the occurrence of a sudden hemorrhage."

So persistent dyspepsia is our leading feature, while we must bear in mind always that, even without dyspepsia, ulcer may exist.

The other symptoms are well recognized, and, when present, they suggest to any tyro the diagnosis. Vomiting and pain are the symptoms most conspicuous; disturbances of secretion and motility are the important facts upon which to establish our conclusions.

It seems needless here to consider at length the symptomology of ulcer, but a few words quoted from the excellent monograph of Greenough and Joslin may show briefly the importance and significance of symptoms, so far as they may be shown in the study of a few cases: —

"The order of frequency of the chief symptoms occurring in the hospital patients was as follows: —

Frequency of Symptoms	Total Number of Patients, 187
Vomiting	179 cases, or 95.7 per cent
Pain	173 cases, or 92.5 per cent
Vomiting of blood	147 cases, or 78.6 per cent
Pallor	131 cases, or 70.1 per cent
Tenderness	130 cases, or 69.5 per cent
Constipation	123 cases, or 65.8 per cent"

What these writers say in regard to the time of vomiting is extremely interesting and corresponds closely with later investigations. "*Vomiting* was the symptom most uniformly present, being absent in but

four patients, and with the matter left doubtful in four others.[1] The *time* of vomiting was so variable in the different patients, and in fact in the same individual, that little of value could be gleaned from the records in this regard. This is unfortunate because the statements of authors diverge so widely on this point. Ewald and Leube say the vomiting occurs soon after eating. Boas puts it at the height of the paroxysm of pain, and Osler 'not for two or more hours after eating.' Hemmeter does not commit himself. Thus these conflicting statements show that the time of vomiting is not a factor in diagnosis. The quantity of the vomitus is also indefinite, for one must take statements of the amount of vomitus with caution." These questions of the time and amount of vomiting are of much negative interest, for in the experience of the writers, as of that of the authors just quoted, there is no rule; so that for diagnostic purposes the mere fact of vomiting, and sometimes its quality alone are of value.

The presence, location, and character of *pain* also vary greatly; though in the majority of cases pain is present, — most commonly in the epigastrium and also in the back not infrequently. Pain referred to other regions, such as the hypochondrium or the shoulders, is not nearly so frequent. Of the one hundred and eighty-seven patients studied by Greenough and Joslin, fourteen had no pain. Our own study of cases shows us that *tenderness* has no regular relation to pain, an observation contrary to that of Osler and Leube; while

[1] This is the more interesting in view of our appreciation of the fact that many cases of gastric ulcer run their course without vomiting.

Fitz says that pressure sometimes aggravates and at other times lessens pain.

It appears to be more difficult, with our increasing knowledge of gastric ulcer, to estimate just how often *hemorrhage* is present in that condition; but it is very certain that it may be absent from a large group of cases. The estimated percentages vary all the way from 46[1] to 81.[2] Hemorrhage appears to bear no special relation to age or sex, to duration of the ulcer, or often even to food; so that for diagnostic purposes we must regard it merely as one of a symptom-complex.

Writers discuss sundry other symptoms, such as pallor, which, after all, when investigated shows us only that the blood is that of a chlorotic type of anæmia; and constipation, which must properly be regarded as a symptom of no diagnostic value.

All of these questions must be considered further in detail.

To one reading the literature of gastric ulcer, quickly it becomes apparent that too little regard is paid in the discussion to the various *types* of ulcer; yet the type in a great proportion of cases is of the utmost importance when we come to consider treatment. For our purposes we may discuss three types, *erosions*, *acute round ulcer*, *chronic ulcer;* and surgically the third form is far the most important.

Let us omit, from the present consideration, syphilitic, tubercular, and malignant ulcers, and study those forms described as simple ulcers by Cruveilhier, as well as the erosions of Dieulafoy.

The erosions are "simple," mere bleeding abrasions

[1] Leube. [2] Greenough and Joslin.

of the epithelium, from which, however, *alarming venous hemorrhage* may occur; and there are the more extensive erosions which may involve large portions of the mucosa of the stomach.[1] These conditions are impossible of diagnosis during life, except by operative exploration; and the treatment of them, though usually consisting of rest and careful dieting, may involve gastro-enterostomy for drainage, — to be considered later.

The round ulcers of the acute and chronic form are often exceedingly difficult of differentiation, though the typical cases are very obvious. As a cause of dyspeptic conditions, acute ulcer occupies a place subordinate to chronic ulcer, and that this is true we are coming to recognize clinically. Acute ulcer attacks the victim suddenly, it tends spontaneously to heal, it may have as symptoms hemorrhage and pain, one or both; but there is reason to suppose that often pain is the only symptom. Without seeking advice, patients seem to find that food increases the pain. They learn to abstain and to employ a careful diet, so that in a few days, often, apparent healing takes place.

The cases of *acute* ulcer which do come to the physician or the surgeon are of a more alarming type, but probably are a minority of all the cases of acute ulcer, and this fact every practitioner constantly must bear in mind. You are never safe in assuming that no ulcer has been present merely because there has been no hemorrhage. The commonly accepted symptoms of acute ulcer, hemorrhage and pain, are familiar enough.

[1] The clinician should never forget the hemorrhages from the stomach due to disease of the liver and kidneys.

There may have been a few days of gastric distress or there may not, and often the patient's first knowledge of trouble is a sudden, profuse, and alarming hemorrhage, or an agonizing pain in the epigastrium. If a hemorrhage is all there is to it, the affair will usually take care of itself, with rest and fasting. People rarely die from these acute-ulcer hemorrhages, and operations are not immediately advisable. But pain is a far more serious symptom, especially when it is sudden and severe. It often means perforation, and is followed by collapse, a rising pulse, a rising and then a subnormal temperature, exquisite localized tenderness, distention, peritonitis. In these cases we must operate and operate quickly, — open, wash, suture, drain.[1] These cases of *acute* ulcer are seen most commonly in young women, and the proportion of women to men is as three to one. It is said that they tend spontaneously to heal. Of this generally accepted statement, however, it is difficult to find the proof, and if proof there be, it is impossible to foretell what sequelæ may develop.[2]

However this may be, the *chronic* ulcers are commonly seen at a later age and more frequently in men, the

[1] Riegel, *loc. cit.*, p. 594. "The change in the condition of the patients is very rapid. They fall into collapse, they look very ill, the pulse is small and threadlike, cold perspiration breaks out, and the extremities feel very cold. Peritonitis itself causes few symptoms, and all the signs of this condition are usually masked by the general symptoms we described. The temperature rises only a little, and may occasionally become subnormal. Traube was the first to call attention to the fact that vomiting is usually absent in cases of free perforation. The absence of vomiting may be considered an important diagnostic sign."

[2] Finney has collected from the literature 268 cases of perforating gastric ulcer: 139 recovered and 129 died, a mortality of 48 per cent; and of the 21 more recent cases, 13 recovered and 8 died, a mortality of 38 per cent.

proportion here being three men to one woman. If we accept the statement that acute ulcers in women are found between the ages of twenty and thirty, we must recognize that the chronic ulcers in men occur between the ages of thirty and fifty. One difficulty in all this reasoning is that there is no satisfactory evidence to show that acute ulcers may not linger to become subacute and eventually chronic, and these considerations lead us to ask the old question, not yet satisfactorily answered, What is the cause of gastric ulcer?

It does not fall within the scope of this book to discuss at length the much-debated question of etiology,[1] but a few words on the subject seem necessary. The literature is enormous; a recent writer gives a bibliography of some one hundred and seventy-five names, and his list is only partial.[2] Traumatism seems to enter into the problem, and it is certain that hemorrhage into the gastric mucosa may be caused by a fierce blow. It is also certain that there may be a loss of substance from any mechanical cause, and that ulcers may then develop. We know from statistics that ulcers are most commonly found in the lesser curvature of the stomach and in the region of the pylorus, — the portion nearest the bile ducts, as well as the part usually injured when the organ is subjected to external violence, especially

[1] W. J. Mayo (*Journal of American Medical Association*, Vol. XLII, p. 1547) gives in a few trenchant words the gist of the matter: "Mechanical injury of the pyloric portion and excessive acidity of the gastric secretions, under anæmic conditions, give rise to ulcer and lie behind the pre-cancerous lesions which Ochsner notes are found in the history of cancer of the stomach in the majority of cases." ("Mechanical injury" means often irritation due to gall-stone disease.)

[2] Riegel, *loc. cit.*, pp. 543 *et seq.*

if the stomach is distended with food or gas. It is stated by one writer that "the reason for this [susceptibility to violence] is that this portion of the stomach is in close proximity to the unyielding spinal column."

Leube, in his essay on diseases of the stomach, published in Ziemssen's Handbook for 1878, says, "A weak constitution, chlorosis, and anæmia predispose more to ulcer than a vigorous body;" and we know certainly how clinicians have established the fact that chlorotic and anæmic subjects are more predisposed to ulcer than are robust and healthy subjects. And Riegel says: "We shall see that hyperchlorhydria does not lead to the development of chronic ulcer, but that it plays an important rôle in preventing its cure. If we conceive that hyperchlorhydria is present in the majority of the cases of chlorosis, this alone may explain why ulcer of the stomach and chlorosis are so frequently found together."

Then there is that factor of alcohol, — but this is not proven to be an important element in the etiology of gastric ulcer.

It seems probable that extensive burns of the skin are sometimes followed by gastric and duodenal ulcers, the latter being more common than the former; while Letelle and others have pointed out the possibility of ulcer being due to infection.

As early as 1855, Virchow called attention to the importance of circulatory disturbances in the etiology of ulcer, and somewhat later Claude Bernard pointed out the probability that an abnormal increase in the acidity of the gastric juice could cause ulcer of the stomach, even though the alkalescence of the gastric mucosa remained normal.

Leube believes in the coincidence of two elements that lead to erosion, namely, anæmia and temporary abnormal acidity of the gastric juice, — and claims that both these factors must be present in order that chronic ulcer of the stomach develop.

Here is an interesting quotation from Riegel's article: "I have always maintained that the reasons why circumscribed areas of the stomach are digested and an ulcer is formed as soon as the circulation is interrupted, is not that the secretion of the tissues becomes acid instead of neutral, but that trophic changes occur; that the tissues are not sufficiently nourished, and consequently die. Dead tissue is naturally digested by the gastric juice. We know that gastric juice does not destroy delicate layers of epithelium during life; as soon, however, as life ceases, the gastric juice acts on the dead tissue in the same way as it acts on the ingesta. Autodigestion of the stomach, during life, is impossible.

"In conclusion, I repeat it is not so wonderful that ulcers are formed in the stomach, as that round ulcers of the stomach are so difficult to cure in healthy persons and in normal animals, whereas ordinary injuries of the gastric mucosa heal with such rapidity. The reason for this is nothing more than abnormal irritability of the secretory organs of the stomach, that manifests itself in hyperchlorhydria."

A further and extremely interesting suggestion is embodied in the following words of Stockton: "The object of this paper is to suggest that by the influence of some process analogous to herpes, or to idiopathic hæmatoma auris, or to Raynaud's disease, or to herpetic gangrene, — some distinct and persevering nerve-pertur-

bation, — we may best explain the recognized and unaccounted for feature of the clinical history as to location, age, and sex."[1]

We have already noted that the pyloric area is the common seat of ulcer, and this is a well-established observation; but a multiplicity of ulcers in the same stomach and duodenum is not generally appreciated. The figures of Brinton are frequently quoted, in which he gives a list of four hundred and sixty-three cases, fifty-seven of which had two ulcers, sixteen had three, three had four, two had five, and four had more than five, — that is to say, 19 per cent of these cases had two or more ulcers.[2] If anything, clinical experience goes to show that Brinton's estimate of multiplicity is too low, and it is certain that ulcers recur frequently in the same organ. We see stomachs with several scars in them, and we see an open ulcer associated with old scars. How many of these may have been active processes at the same time it is impossible to say; but it is fair to assume, from a large series of rather unsystematized observations, that multiple ulcers of the stomach, as well as of the duodenum, are not uncommon. One object of an early operation is not only to cure the ulcer present, but by drainage to anticipate a tendency to subsequent ulcer formation.

Granted, then, that peptic ulcers are due to a localized necrosis of the mucosa, acted upon by the digestive juices, and that the ulcers may be single or multiple, the wonder should be not that they are chronic and ob-

[1] Charles D. Stockton in *Medical News*, Jan. 14, 1893.

[2] W. J. Mayo, *loc. cit.*: "In 20 per cent of cases more than one ulcer is present."

stinate, but that they heal at all. Their size and shape are various, the term *round ulcer* is not often applicable; they may go on extending and destroying very considerable areas, eating into the submucosa, the muscularis, the serosa, and even into neighboring organs, giving rise to extensive and serious complications. As a rule, however, and as physicians meet them, they are limited and amenable to treatment; for, provided they are recent and *have not destroyed the muscularis*, they may heal, as is shown by the frequency of ulcer scars. As Hauser has pointed out, healing occurs by regenerative proliferation of the connective and glandular tissues that are in immediate proximity to the defect. The cells of the mucosa near the margin of the ulcer chiefly undergo proliferation. Hauser frequently found a large number of tubules in the centre of scars. The tubules were placed vertically to the epithelial surface; some of them, however, ran diagonally and others parallel to the mucosa. They were either as broad as ordinary gland tubules or they were in a state of cystic dilatation. They were not lined by glandular epithelium, but by a species of cylindrical epithelium. None of these tubules had an open lumen. Hauser states that these peculiar structures no longer perform a secretory function, but are merely *adenoid neoplasms*. This last statement is extremely interesting in connection with the subject of malignant growths in the stomachs of persons previously subjects of ulcer.

Those ulcers which do not heal must obviously become the source of chronic invalidism in their further course.

There seems to be no good reason not to accept the

statement of numerous writers, that hyperchlorhydria is the result of ulcer present, for it is fair to assume that the lesion may well keep up a condition of irritation leading to the excessive secretion of HCl. So we have a vicious circle, — the HCl is necessary for the maintenance of the ulcer, and prevents its healing; the ulcer in its turn stimulates the excessive production of the HCl.[1]

It used to be thought that hyperchlorhydria was the cause of "heartburn," but this has been demonstrated to be untrue. Pyrosis is due to gastric fermentation, usually. Then, there is that word *dyspepsia*, a symptom difficult of definition. If we mean a disturbance of digestion, and that digestion is rendered more difficult or retarded, we can hardly call ulcer a cause of dyspepsia; for in ulcer, stomach digestion is often expedited rather than retarded, and this is due to the presence of hydrochloric acid in excess. Of course

[1] J. A. Vieregge in the *St. Paul Medical Journal*, Vol. X, p. 133, quoting A. Matthiew and I. Roux (*Gazette des Hopitaux*, 1903, No. 66), says: "The chemistry of the stomach is of special importance in three or four different pathological conditions; namely, ulcer, carcinoma, and gastritis or dyspepsia. In carcinoma free HCl is quite often absent and the combined HCl is present in small quantities only. The change is due to an atrophy of the mucous membrane. It is, however, not pathognomic for carcinoma, and may be found in other affections. The hypochlorhydria, then, only speaks for carcinoma when it is associated with other symptoms. In other cases the carcinoma has developed from an ulcer or the scar of an ulcer. In the latter affection there is mostly present hyperchlorhydria, which concerns the free HCl as well as the combined HCl. It is of the greatest importance to settle this question when there is any doubt about the nature of the affection. Nevertheless, the hyperchlorhydria of ulcers is of the same importance as the hypochlorhydria of carcinoma. Therefore, hyperchlorhydria, with a certain amount of stasis and hypersecretion, on an empty stomach in the morning, is almost pathognomic for pyloric ulcer."

there are exceptions, as in the case of an associated gastritis or dilatation, with pyloric obstruction, when food remains overlong in the stomach, and thus causes heartburn.

From this brief account of the nature of ulcer, it is apparent that its duration is uncertain, and its prospect of healing equally so; that we must often fail of making the diagnosis; and that many cases of faulty digestion are long continued without ulcer as the cause being suspected. Indeed, it seems more and more probable, from whatever viewpoint we approach the problem, that peptic ulcer is not an uncommon condition. Let us then attempt briefly in some fashion to formulate our ideas regarding

Diagnosis. — No single symptom is sufficient in itself to establish the diagnosis; we must look for a symptom-complex, and the symptom-complex many times is lacking even after patient search.

The questions of erosions and acute ulcers need not detain us, for either such conditions are relieved spontaneously and by the patient's own care of himself, or the symptoms are so alarming that with the factors age, hemorrhage or pain, and collapse, the diagnosis is obvious and the line of treatment clear.

It is with chronic ulcer that we are at present concerned, and it is chronic ulcer which is commonly meant by writers discussing ulcer.

Here is a suggestive little paragraph from an article by M. C. Millet,[1] suggestive because it seems to explain the views of many clinicians, — suggestive rather than instructive or convincing: "Clinically we may classify

[1] *St. Paul Medical Journal*, p. 193, 1903.

chronic gastric ulcer as the gastralgic, catarrhal or vomiting, dyspeptic, hemorrhagic, or cicatricial form, according to the prominence of individual symptoms." Such a classification is well enough, perhaps, though a little confusing, for "dyspeptic" and "catarrhal" seem to be much the same thing, and "vomiting" is often quite distinct from either of the other two.

Pain[1] is usually regarded as present in nearly all cases of ulcer, — thus Greenough and Joslin say, "The pain was definitely located in practically all the cases," and Riegel says, "The most prominent symptom of ulcer is pain." Doubtless this is true in cases of ulcer clearly diagnosticated, but we must remember that ulcer sometimes develops slowly, that it is often secondary to bile-duct disease, that it may heal spontaneously, that in a number of cases pain may not be present (indeed, in Greenough and Joslin's list it was absent in fourteen of their one hundred and eighty-seven cases), and that an obscure case must be relegated to Millet's class Dyspeptic. In the beginning of ulcer there is merely a feeling of distress after eating,

[1] SITUATION OF PAIN

Epigastrium		91
Epigastrium and back	23	
Epigastrium, back, and chest	2	
Epigastrium, back, and right costal border	1	
Epigastrium, back, and left hypochondrium	5	
Epigastrium, back, and right hypochondrium	2	
Epigastrium and left hypochondrium	8	
Epigastrium and chest	4	
Epigastrium and between shoulders	2	
Epigastrium and left shoulder-blade	3	
Epigastrium and umbilicus	1	51
Total epigastrium and elsewhere		142

and this condition may exist for many years without developing further symptoms. Indeed, in the condition of gastrectasis have we not seen that many cases with pyloric obstruction, undoubtedly due to ulcer, never develop further symptoms beyond distress? Pain, then, may be a late symptom. When present, it appears in paroxysms; it is usually strictly localized.

There are exceptions, however, to the paroxysmal character; in some cases discomfort amounting to pain may constantly be present, and in such cases we must suspect a circumscribed peritonitis and adhesions causing pain. Pain may therefore be associated with certain positions of the body, for standing or turning on one side may cause dragging on adhesions. So we must distinguish two pains: the pain of ulcer *per se* and the pain resulting from a local peritonitis.

It is in association with food, however, that characteristic pain is seen. Immediately upon taking food an increased secretion of gastric juice takes place, and the ulcer becomes irritated either by the acid directly, or mechanically by the peristaltic movements of the stomach.

We will grant that the character of the pain has established for us with fair certainty the presence of ulcer; but can we, from its location and time of onset, answer another leading question, *Where* is the ulcer? Our conviction is that we cannot do this with any certainty. We may be able to differentiate duodenal ulcer from gastric ulcer, for in duodenal ulcer the pain is said to come on late and to be in the back often; but when it comes to locating accurately ulcer within the stomach cavity proper, there are many sources of

error. Granted that in more than 75 per cent of the cases the ulcer is in the pyloric area, or ulcer-bearing zone, it does not necessarily follow in that case that pain will be delayed longer than when the ulcer is in the greater curvature or the cardia. The size of the ulcer, the amount and character of food, the degree of hyperacidity, the position of the stomach, all enter into the problem of the production of pain; and after all, practically, for purposes of treatment, accuracy in determining the seat of lesion is not essential.

And pain may be due to cicatrices. Especially is this so when we have to deal with stomachs distorted, narrowed, or displaced. Food enters into such a stomach, and from its attempt properly to deal with the food, pain frequently results.

A great deal has been said and written about tenderness on pressure, — about the location of such tenderness, its intensity, the extent of the painful area, and what it all means, — but such writing is not conclusive. We can say, however, that in gastric ulcer the same tenderness is nearly always present in the same individual.

Much has been written also about dorsal pain on pressure. Cruveilhier talked about it nearly seventy years ago. Boas says that it is present in about one-third of all gastric ulcer cases; it is often associated with epigastric tenderness and is situated a little to the left of the dorsal vertebræ, between the seventh and the twelfth spines; and all this is helpful in forming a diagnosis.

So much for pain, which, as a definite symptom, is not at all satisfactory evidence of the presence of active

gastric ulcer, for exactly similar pain may be due to disease of the bile passages and to pancreatitis.

Vomiting is a symptom more important than pain, we are convinced, though Riegel says it is not constantly present. On the other hand, Greenough and Joslin found it absent in but four cases out of their one hundred and eighty-seven cases, and Welch says that next to pain it is the most frequent symptom of gastric ulcer. Ordinarily it is associated with pain; it comes on some hours after eating and results in the relief of pain. There are causes for vomiting other than gastric ulcer, but the same is true of pain; it is a peculiar combination of pain relieved by vomiting which we regard as characteristic.

It is the *vomiting of blood*, however, which gives us the symptom erroneously regarded by many as peculiarly characteristic of ulcer. As we have already pointed out in this chapter, authors differ widely as to its frequency, and the figures range from 28 per cent to 90 per cent of all cases. Here, again, the clinician is forced to the conviction that mere autopsy records, or even clearly proved clinical records of ulcer cases, do not tell the whole truth. In a series of fifteen cases, which we have seen recently demonstrated as ulcer beyond peradventure by scars found at operation, only one case gave a history of vomiting blood; and other operators tell the same story.

The character and the amount of the blood lost are not particularly significant.[1] Small amounts of par-

[1] Greenough and Joslin's tables of one hundred and eighty-two cases: one hundred and forty-seven vomited blood; in eighty-six of these cases the hemorrhage produced constitutional symptoms, in only nineteen

tially digested blood, — the familiar "coffee-ground" vomiting, mean no more than large amounts of bright blood. One is due to capillary oozing, the other to the erosion of vessels.

Again, very severe hemorrhage, leading even to the death of the patient, may occur from gastric ulceration near the pylorus or from duodenal ulcer; yet no vomiting may result, the blood being passed off by the bowel in such cases. When copious, it is usually detected in the stools. We must be on our guard, however, against trusting to the patient's statements; for small amounts of partially digested blood in the stools can be recognized only by the expert. And, too, hæmatemesis gives no clear idea of the location or extent of the ulcer.

Dyspeptic symptoms, as we have said, cannot be trusted as evidence of active ulceration. Dyspeptic symptoms, long continued, are always suggestive, however, especially when they are not relieved by treatment; and it cannot too often be repeated that the scars left by a healed and unsuspected ulcer are frequently the cause of long-standing dyspepsias.

Fever is not a symptom of ulcer, but we must remember that the presence of fever is no indication of the absence of ulcer. Fever may be due to complications from deep extension of the process, or to perforation associated with localized peritonitis.

It does not seem necessary to refer again to the ques-

cases did hemorrhage precede symptoms of ulcer. There was fatal hemorrhage in seven cases, or 3.7 per cent; and in three of this number it was the first symptom: males 17 per cent, females 1.27 per cent. From a study of ages, in fatal hemorrhage, they conclude that the younger the individual the less likelihood is there of death from hemorrhage.

tion of analysis of the stomach contents, beyond repeating the well-recognized statement that if the analysis be made after a test breakfast, the secretion of gastric juice is found greatly increased, and that the time of digestion, in case the pylorus is not obstructed, is diminished rather than increased. Often the stomach will be found empty one hour after the test breakfast.[1]

Riegel insists upon the fact that the results of the examination of vomitus are less significant than the examination of the stomach contents removed by the tube after a test meal. "Any physician who has had occasion to examine many stomach cases knows that the analysis of the vomit always yields doubtful results, because so many sources of error exist."[2]

In the chapter on appendicitis we take the ground that chronic and recurring forms of that inflammation, rather than acute appendicitis, fall properly within the scope of this book. For the same reason we shall say little of that alarming catastrophe, perforation of the stomach, which may result from the presence of gastric ulcer. Perforation can scarcely be called a digestive disorder in the sense which would warrant an elaborate consideration of the subject here. The symptoms of perforation have already been described briefly, and the question of treatment will be dealt with later.

Subphrenic abscess also is a complication which need only be mentioned in this connection, and the broad consideration of ulcer complicated by cancer will be taken up in a subsequent chapter.

Hour-glass stomach — its causes, symptoms, and diagnosis — deserves a few words. This condition is due

[1] See Appendix.

[2] Riegel, *loc. cit.*, p. 592.

usually to ulcer, and as such it should be ranked among the complications or sequelæ of that disease.

Riegel, in his elaborate essay, deals with the subject slightingly, for he calls it a condition that is occasionally congenital or which may result from ulcer; and he makes the surprising statement that nearly all the cases of hour-glass constriction of the stomach which have so far been observed were found by chance at autopsy.[1] He proceeds to remark that doubtless this condition could be diagnosticated during life in a majority of cases if the patients were examined with sufficient care.

From such observations, it is evident that Riegel is not familiar with the English and American literature on the subject; for a great deal of work has been done and extensive observations on hour-glass stomach have been made in those countries. Riegel does admit, however, what we believe to be the fact, that hour-glass stomach is due to ulcer or other inflammatory processes and is seldom congenital.

Moynihan has convinced himself that nearly all cases of hour-glass stomach are acquired;[2] in this he differs from the Fenwicks, Meckel, Sandifort, Roger Williams, and numerous other writers whom he quotes, and his argument is an interesting and important one. After

[1] The following figures collected from the literature of the subject have been presented by Watson: twenty cases of congenital hour-glass stomach; twenty cases of acquired hour-glass stomach not operated upon; twenty-nine cases of acquired hour-glass stomach operated upon. Three gastro-enterostomies with no deaths; seventeen gastro-plasties with three deaths; six cases of gastro-anastomosis with one death; one case of inversion of the ulcer with one death; one case of artificial gastric fistula with one death.

[2] "The Surgical Treatment of Gastric and Duodenal Ulcers," by B. G. A. Moynihan. Philadelphia, 1903.

describing the claims of those who assert the congenital origin of such cases, Moynihan goes on to say: "Without entering in detail into this discussion I may say that I have very carefully considered the question as to the existence of hour-glass stomach as a congenital deformity, examining all the specimens that I could find and reading carefully the records of, I believe, all the published cases; but I remain confident in my belief that there is no *evidence whatever* which will establish the claim of those who assert that the disease is often congenital in origin. Since I first threw doubts upon the congenital origin of many of the cases of hour-glass stomach, and showed that, in almost all of the cases, obvious evidence of old ulceration could be found, several investigators have supported my conclusions by observations made during the course of operation, or on post-mortem examination. There is indeed no inherent improbability of the existence of congenital hour-glass stomach; but it lacks proof." Few of us doubtless have had large experience in dealing with hour-glass stomach, and evidence of its congenital origin is rather negative. We have ourselves operated upon two cases of this condition, and both obviously were due to gastric ulcer.

In general terms one may say the hour-glass contraction is due to three acquired causes: —

1. *Ulcer, whether perforating and causing adhesions, or non-perforating.* Those ulcers which cause adhesions may involve extensively portions of the stomach with neighboring organs, so that the lumen of the stomach may be nearly obliterated; this form of hour-glass stomach is far the most difficult to deal with by opera-

tion. The chronic ulcer which does not perforate may, however, cause an hour-glass constriction, and this perhaps is the form most commonly seen. If the ulcer is very extensive, nature's attempt at healing may cause an immense thickening with cicatricial contraction about the lesion, so that great deformity of the stomach may result. And we do not always find a clear history of ulcer even in these extreme cases.

Some months ago we were consulted by a patient with a dilated stomach, who gave a history of having had for five years pain immediately after taking any form of food, even water. She had never vomited; there had been no evidence of hemorrhage, and never any special tenderness; there was marked hyperchlorhydria, and she had been regarded by physicians as a dyspeptic of the hyperacidity type. The stomach was somewhat prolapsed and considerably distended. On opening the abdomen we found an hour-glass constriction of the stomach, about three inches from the pylorus, and on opening the stomach itself the dense cicatrix of an old ulcer was found as the obvious cause of the difficulty.

Such cases as this confirm our frequent suspicion that serious malformation of the stomach, leading to the most distressing and dangerous symptoms, may long exist without the possibility of our making a diagnosis of ulcer.

In this case we found a condition which Moynihan also has pointed out, namely, a narrowing of the pylorus. This narrowing was probably of short duration, but that it frequently does exist coincidently with hour-glass stomach seems well established, and is a

further argument in favor of our repeated contention that multiple ulcers are more frequent than figures show.

2. *Perigastric adhesions* may cause hour-glass stomach. This condition as the cause of hour-glass stomach is probably much less common than is ulcer. We refer to adhesions due to old peritonitis of some source other than ulcer of the stomach, — tubercular peritonitis, inflammation extending from the gall bladder, the pancreas, the appendix, or even originating in the pelvis.

3. *Cancer* of the stomach or some neighboring organ may cause the hour-glass deformity. Several such cases are reported.

In spite of the opinion of Moynihan, we believe that it will always be difficult, in a great many cases, to establish the diagnosis of hour-glass stomach before operation. That writer says that of his first six cases only one was diagnosticated; but that in his last eight cases, six were diagnosticated with certainty. Doubtless the diagnosis may be made in those typical cases in which the constriction is near the middle of the stomach; but when near the pylorus, as not infrequently happens, diagnosis is often impossible. Indeed, in a case known to the writers, an hour-glass restriction, two inches from the cardiac orifice, was overlooked even at operation; and in the case reported on a previous page, we doubt if the hour-glass constriction, three inches from the pylorus, could have been determined before operation.

Writers describe various means for arriving at the diagnosis; and four of these means have proved themselves of value.

1. If the stomach be washed out until the water returns clear and there then follows a gush of foul fluid, it is probable that a second pocket exists; or if, a few minutes after one thorough washing, the tube be reintroduced and a second supply of filthy detritus be obtained, that is further evidence. This is Wölfler's second sign.

2. Wölfler's first sign is arrived at as follows: pass the stomach tube, wash out with a known quantity of water, and note the loss of a certain amount. The portion of the water not returned has escaped into the second cavity of the stomach.

Both of these methods have repeatedly led to error and every clinician knows that it is not possible, even when dealing with the normal stomach, always to secure again the full amount of water injected.

3. Paradoxical dilatation, as it is called: shake the abdomen and obtain the splashing sound, then pass the tube, empty the stomach, and you will find splashing still to persist. This last splashing comes, of course, from the second pouch, which has not been emptied.

4. Moynihan has a sign of his own which is useful. Map out the stomach resonance, give a Seidlitz powder in two portions; after twenty or thirty seconds an enormous increase in the resonance of the upper part of the stomach can be found, while the lower part remains unaltered. Later the lower pouch may be seen to fill up.

As we have said, we know nothing characteristic in the symptomology of these cases. After all devices the diagnosis remains difficult, and not infrequently it will

be found at operation that an unsuspected hour-glass stomach presents itself.

DUODENAL ULCER[1]

Etiologically, duodenal ulcer must be regarded as in the same class with gastric ulcer.[2] It arises from the same causes,[3] and it presents similar appearances. But it is a graver lesion because the duodenum is of a very much thinner and more delicate structure than the stomach, consequently the blood-vessels are more easily eroded. More than that, it does not so often cause noticeable symptoms, though we are coming to see that frequently it may be mistaken for disease of the bile passages.

The same questions and doubts about the frequency of duodenal ulcer and its multiplicity meet us as when we dealt with gastric ulcer; and, further, writers disagree as to its frequency relative to gastric ulcer. Certainly, duodenal ulcer seems to be the less common of the two, and the relation, as reported by writers, varies all the way from one in nine to one in forty. Ulcers of the stomach and duodenum are not infrequently found present in the same individual.[4]

[1] Bibliography: A. Krauss, a monograph covering the literature of duodenal ulcer up to 1865; Chvostek, the literature up to 1882; Oppenheimer, literature up to 1891. Perry and Shaw, *Guy's Hospital Reports*, 1893; Cullen, *Scotland Medical and Surgical Journal*, 1897, Vol. I, p. 635; Samuel and Soltau Fenwick, "Ulcers of the Stomach and Duodenum," 1900; Hemmeter, "Diseases of the Intestines," 1901, Vol. I.

[2] W. J. Mayo, *loc. cit.*: "The only portion of the duodenum in which we are interested is the four inches lying between the pylorus and the papilla of the common duct of the liver and pancreas. This may be called the vestibule of the small intestines."

[3] How frequently it is due to extensive superficial burns we know not. Who has seen many such cases?

[4] "Chvostek remarks that the statement made by many authors,

Variations in the locations of the ulcers are described by writers, but the ulcers' most frequent and important site is in the first four inches of the duodenum.

Ulcers forming in the portion of the duodenum below the ampulla of Vater, though rare, may cause a variety of complications in their healing, the most striking of which is partial or complete cicatricial closure of the duct, with consequent icterus, or atrophy of the pancreas from stasis.

Those ulcers nearer the pylorus, however, are far the most important for our consideration. They are important, not so much for their early symptoms, as for the frightful danger of their presence. Ulcer of the stomach is bad enough, because it may lead to chronic invalidism; ulcer of the duodenum is worse, because it may lead to sudden death. Frequently it may give rise to fatal hemorrhage, it may result in perforation and involve other organs, and it may result in cancer.[1]

Pain is not necessarily present with duodenal ulcer, or it may be continuously present; when continuous, the pain is probably due to circumscribed peritonitis rather than to the ulcer itself. As we said in comparing gastric with duodenal ulcers, it is generally supposed that pain in the latter comes on from four to six hours after eating; but this assumption is not a safe one, for pain may be early or late in either form of ulcer.

among them Krauss, that cicatrized duodenal ulcers are relatively rare, is not correct; and that the comparative rarity of this condition is only apparent, and due to the fact that cases in which cicatrices are found by chance during autopsy, but in which symptoms were absent during life, are not published." — Nothnagel, in "Diseases of the Intestines and Peritoneum," p. 241.

[1] The Fenwicks have collected ten examples of this complication.

Patients with duodenal ulcer alone do not often *vomit;* but frequent vomiting does not rule out this condition, for coincident gastric ulcer may be present.

Analysis of the gastric contents gives no light as to the presence or absence of this condition. The chemists vary much in their statements.

There may be *hemorrhage*, shown either as hæmatemesis or melena; and the Fenwicks state that the latter is not necessarily more common than the former; they put the percentage of hemorrhage at 26 in recent duodenal ulcers, and at 40 in chronic duodenal ulcers, the death rate from hemorrhage being variously estimated as from 13 to 36 per cent. Now except for symptoms simulating cholelithiasis, these are all the symptoms that can be produced by ulcer of the duodenum as distinguished from ulcer of the stomach, and it is apparent that a positive differentiation rarely is possible. The location of the pain is not distinctive, the bloody stools are not distinctive, and of the other signs the variation is nil.

Perforation from duodenal ulcer is so grave a misfortune that we must think of it as distinct from the perforation of gastric ulcer. It is apparently more sudden because less likely to be preceded by symptoms.[1] Both, commonly, are fatal if untreated. Until recently

[1] T. C. English in the *Lancet* for December 19, 1903, describes a series of fifty operations for perforation, with a mortality of 52 per cent. Five of his cases had had no previous gastric symptoms of any kind. He points out that in a great majority of cases the onset is sudden and without warning. The situation of the pain is no guide, as it is often most intense in the lower portion of the abdomen. Contrary to the experience of most writers, vomiting occurred in 75 per cent of his cases. He describes the pain as "sudden," "terrible," "intolerable," — a pain such as rarely is met with in any other condition.

many of these duodenal perforations went unrecognized until too late for operation; though perforation of the appendix, with a similar train of symptoms, seems no longer to offer difficulty in diagnosis to practitioners. However, we believe that to-day all physicians of any experience realize the serious nature of symptoms suggesting even remotely perforation of organs in the upper portion of the abdomen. All surgeons have recognized the marked similarity between the symptoms of perforation of duodenal ulcer and those of a perforated appendix. Not only are the evidences of shock and collapse, with a spreading peritonitis, much alike in both; but the area of pain and tenderness in both is often below the umbilicus. We must realize that such pain and tenderness in the right inguinal region following the perforation of a duodenal ulcer are due to the fact that the infecting material from the duodenum is poured out over the right renal area, and by the action of gravity settles in the right flank and in the neighborhood of the appendix. Moynihan records forty-nine cases of perforated duodenal ulcer, in eighteen of which the diagnosis of appendicitis was made; and such an experience is common to us all. Of course, such an error in diagnosis is of no serious importance if we follow the usual custom of operating in all these acute conditions.

So far as we know, there can be no expectation of a cure in cases of duodenal perforations not operated upon. The operation, to be efficient, must be instant; after eight hours' delay the prognosis is very grave. Opening the abdomen, suturing the perforation, suprapubic pelvic drainage, and after treatment in a sitting position have reduced the mortality below 20 per cent,

according to Mayo's figures. With these recoveries is associated apparently the healing of the ulcer.

MEDICAL TREATMENT OF PEPTIC ULCER

We do not propose advocating any special form of treatment for gastric ulcer; but we do most earnestly add our word to the words of many careful observers, in Europe and in this country, who have come to feel that reliance upon internal treatment in these cases often is vain. From what we have said of the site, appearances, progress, and depth of ulcers, this conclusion seems inevitable. There are many things about an ulcer which we cannot ascertain when it is hidden in the stomach or duodenum. We cannot tell how many ulcers there are; we do not know how deeply the ulcer may have gone; we cannot be sure of the extent of cicatrices; we cannot make certain of the absence or presence of adhesions, and for a time, at least, of the partial closure of the pylorus.

Then there is that impossibility of determining, with the subsidence of symptoms, whether or not our ulcer truly is healed. Robson and Moynihan well put the matter when they say: "It is useful to hold in view the course of an ulcer of the leg, which, directly the healing stage has arrived, becomes free from pain. But this neither indicates that healing is completed, nor that care may cease."

It does not seem necessary here to elaborate the matter of medical treatment. The main principle in such treatment is *physiological rest.* Clinicians differ as to details when they talk of means of securing rest, but in all cases rest is the one great desideratum.

Since the work of Cruveilhier the rest cure has been the recognized method of procedure, and that author himself constantly asserts that this is the fundamental condition for a complete cure of ulcus ventriculi. Such has been the teaching and the practice of sound clinicians for the past seventy years, and we see that their purpose must be to secure quiet for the stomach and to banish hyperchlorhydria. We have seen how excessive acidity is due in great part to gastric activity, induced by food; and the conclusion, therefore, is obvious that so far as possible we must limit or banish stomach feeding. The limitation of such feeding can secure only partial results, as the blandest foods in least amounts must necessarily increase motility and stimulate the output of hydrochloric acid.

During the past fifteen years rectal feeding has come to take the place of limited gastric feeding in the clinics of many physicians — rectal feeding persisted in for a short time only. The discussion of these two methods is needless here; suffice it only to say that, though unequally successful in securing absolute gastric repose, they are practically equally successful in the number of cures attained.

The most interesting figures bearing upon the subject are those published in 1899 by Greenough and Joslin. As we have heard already, they studied some one hundred and eighty-seven cases, divided nearly equally between two "services" at the Massachusetts General Hospital. In the one service it was the custom to feed by nutrient enemata during the first few days. In the other, rectal feeding was employed in the more severe cases only, the diet being limited ordinarily

during the early days to milk and lime-water by the mouth.[1]

On the average the patients fed by nutrient enemata were on that treatment for 8.39 days; and the shortest period was one day.

The results of these two methods of treatment were as follows: twenty patients, or 32 per cent, who received no food by the mouth were cured; forty-two patients, or 68 per cent, who received no food by the mouth were not cured; twenty-three patients, or 44 per cent, who received food by mouth were cured; and twenty-nine patients, or 56 per cent, who received food by the mouth were not cured. These conclusions refer to the condition of the patients at the time of their leaving the hospital; from which it appears that only 32 per cent of those who received no food by the mouth were cured, in contrast to 44 per cent of cures in those patients who were given small quantities of milk and lime-water from the outset. These writers point out the fact, however, that it was chiefly the severe cases which were put on nutrient enemata alone, and that this fact directly tended to make a less favorable showing for the starvation method. Furthermore, it is interesting that the patients who were starved remained a longer time in the hospital on the average than those who were fed small amounts of milk and lime-water.

[1] The following table shows figures: —

	Service A	Service B	Total
Number of cases with no food by mouth .	71	31	102
Number of cases with food by mouth .	23	60	83
Doubtful	2	0	2

Other observers seem to have felt greatly encouraged by such methods of treatment, whether with or without rectal feeding; but all of them naturally draw a sharp distinction between the results in the cases of recent ulcers and chronic ulcers. In dealing with recent ulcers the figures are far the more favorable; while in the case of chronic ulcers, though relief is experienced often for a time, relapses are frequent. And we must bear in mind that it is among young women chiefly that we see the favorable cases of recent ulcer cured; whereas it is among middle-aged men that we see more commonly chronic ulcers relieved merely.[1] So it comes down to this, that to talk about the results of treatment in ulcer cases as a whole must be unsatisfactory and misleading. A great range of investigations shows that immediate cures, so called, are found in from 60 per cent to 90 per cent of the cases; but owing to the obscurity of conditions actually present in any given stomach or duodenum, it is very difficult to assign cases to a particular class. In general terms, however, one is safe in assuming that a young woman with a recent ulcer stands a good chance of being cured by the rest treatment; while an older person, whether man or woman, with evidences of long-standing ulcer is unlikely to receive more than temporary benefit by such measures; and

[1] "Opinion is divided as to whether rectal alimentation increases or diminishes gastric secretion. Following the observations of Winternitz, it was believed that the gastric acidity was increased by nutrient enemata, but the studies of Ziarko go to show that the acidity of the gastric juice is really decreased by rectal feeding. Bourget, on the other hand, discards rectal feeding, believing that food thus introduced is but slightly absorbed and that by reflex action it increases gastric secretion."—Charles G. Stockton in Riegel's "Diseases of the Stomach," p. 628.

the discussion in our Chapter IV shows us what may be the after-history of this latter class of cases.

Taking the whole number of peptic ulcer cases as a group, what are we to tell these people about their future? This is a question less difficult to answer now than it would have been ten years ago; a few sets of statistics by medical investigators give us some information, and the operative findings of surgeons tell us even more. J. W. Russell, in the *Lancet* for January 30, 1904, gave some interesting figures. He had been able to trace the after-history of forty-seven gastric ulcer cases; the time elapsed since their leaving the hospital being from two to thirteen years, he found that the immediate mortality was 2.1 per cent as compared with Greenough and Joslin's 8 per cent. Russell also found that 42.6 per cent of his cases ended in recovery, 27.7 per cent having had but a single attack, whereas 14.9 per cent recovered after one or more relapses; 44.7 per cent were suffering from stomach symptoms of more or less severity at the time of their last report; 15 per cent were the victims of repeated attacks with intervals of immunity; while 30 per cent were suffering from almost continuous pain. From such studies Russell concludes that in many cases of chronic ulcer medical treatment is proving unsatisfactory.

Wagner of Hamburg[1] writes on the end-results of the medical treatment of gastric ulcer, and his conclusions differ somewhat from those of Russell. He has something to say about the technique, remarking that his purpose is to abolish hyperchlorhydria and cure the anæmia in order to insure permanent health. He gives

[1] *Munich med. Wochen.*, LI, 1903.

his patients concentrated albumen by the mouth and does not use nutrient enemata. He reports sixty cases, but has been able to follow only twenty-five of them; and in all of these twenty-five there had been a history of hæmatemesis. His treatment consisted in four weeks of absolute rest in bed with an ice-bag to the stomach. If hemorrhage occurred, the diet was reduced to drachm doses of iced milk, gradually worked up until ten ounces at a time could be taken; after which one to three beaten-up iced raw eggs were given. He prescribed bismuth in ten to fifteen grain doses daily, for ten days after the hemorrhage. By that time the patient would be taking daily eight raw eggs, two quarts of milk, rice, rolls, and chopped beef.

Of the twenty-five cases which were followed to the end, eighteen, or 72 per cent, were reported in good health, but the length of time since their leaving the hospital was not given; while of the remaining seven cases, one had occasional pain, three had had some pain after leaving the hospital, and two had had subsequent hemorrhages. The report is rather unsatisfactory, as the time elapsed since the hospital discharge is not given.

The general impression one gains from the figures of Russell and Wagner is, that a considerable proportion of ulcer cases relapse. It is unfortunate that more research work of this kind has not been done; but one turns with satisfaction to the often quoted paper of Greenough and Joslin. So far as we know their figures on end-results are the best that we have, and their conclusion, that we must not look to immediate hospital results as final, is the only logical conclusion.

Of those one hundred and eighty-seven cases studied,

these writers were able to report upon one hundred and fourteen after intervals averaging five years; and their figures are so striking that we shall quote them in considerable detail.

Of the one hundred and eighty-seven cases, the results at the conclusion of hospital treatment are summarized in the following table:—

Cured	121	64 per cent
Relieved	34	18 per cent
Deaths	15	8 per cent
Otherwise	17	9 per cent

Then take the one hundred and fourteen cases which were traced after leaving the hospital.

		Recurrence	Dead	Cured	Total
63 Cured	55 per cent	28	8	27	63
29 Relieved	25 per cent	10	4	15	29
15 Deaths	13 per cent	—	—	—	—
7 Otherwise	6 per cent	3	3	1	7
114		41	15	43	99

After an average period of five years the following condition was found to exist:—

Cured 43 + 3	46	40 per cent
Not cured — Recurrence	41	36 per cent
Deaths 15 + 8	23	20 per cent
Deaths, cause unknown	4	4 per cent
	114	

We are told that the mortality was much higher among men than among women, being 30 per cent among the former and only 9 among the latter. The writers note the striking difference between these figures and those of other reporters.

At the Massachusetts General Hospital the immediate total mortality was 8 per cent, while Leube gives an immediate mortality of 2 per cent, which suggests a more severe type of disease at the Boston hospital, especially when we consider that there the percentage of hemorrhage cases was 81; while Leube's percentage was 46; and these writers present the following striking table for comparison: —

	Leube	Mass. Gen. Hospital
Mortality	2.0 per cent	8.0 per cent
Hemorrhage	0.8 per cent	3.7 per cent
Perforation	1.2 per cent	2.7 per cent

Now, of Greenough and Joslin's one hundred and eighty-seven cases, 80 per cent were recorded as cured at the time of their discharge from the hospital; but the striking and important fact is that on later investigation 40 per cent only were found to be well. Of ninety-nine patients who left the hospital, eight subsequently died[1] of gastric diseases; and forty-one had a recurrence of ulcer symptoms. So they note this fact that recurrence took place in one-half of the cases; twelve of this number, however, reported themselves well at the time of writing. The authors make this interesting comment, "It certainly is startling to realize that every other patient with gastric ulcer is either to have a recurrence of symptoms, or is never to be well again."

Among the conclusions of Greenough and Joslin let

[1] Seven other patients died after leaving the hospital: in three of them the cause was known to be other than gastric; in four it was in doubt.

us note the following as bearing particularly upon the subject under consideration: —

Gastric ulcer is five times as common among women as among men.

The average age of the male patients is thirty-seven years; of the female patients, twenty-seven years.

Hemorrhage was present in 81 per cent of these cases. It caused the death of 17 per cent of the male patients, but only 1.27 per cent of the females. No woman under thirty died of hemorrhage from gastric ulcer during this period.

Perforation occurred in 3.2 per cent of the cases, and none of these patients left the hospital alive.

Of the one hundred and fourteen patients traced, 80 per cent were discharged cured and relieved; but at the end of an average period of five years, only 40 per cent remained well. The mortality at the same time (due to gastric disease) was 20 per cent. Among the males it was 30 per cent, among the females 9 per cent.

The excessive mortality of ulcers among men, its occurrence in life a decade later than among women, and the absence of fatal cases of hemorrhage among women points to a difference of the ulcers in the two sexes (men, chronic; women, acute).

The immediate mortality of 8 per cent, and the failure of medical treatment to effect a lasting cure in 60 per cent of the patients, indicates the need of more frequent surgical intervention in other than emergency cases of this disease.

CHAPTER VI

OPERATIVE TREATMENT OF NON-MALIGNANT DISEASES OF THE STOMACH

The operative treatment for non-malignant diseases of the stomach and duodenum offers perhaps the most important problem now before the surgical world, — a problem because not entirely solved, though a great advance toward its solution has been made. The duodenum, or more properly, that portion of the duodenum above the opening of the common bile-duct, — the vestibule of the intestines, as W. J. Mayo calls it, — must be considered together with the stomach, for it is subject to much the same chemical influences, and is the seat of similar disturbances.

These non-malignant lesions result from inflammations, either actually present or remotely causative.

Ulcer is the common offender, and we have seen how frequent that is: ulcer, single or multiple, healed or unhealed, causing hemorrhage, cicatrices, distortions, stenosis, adhesions, dilatation, ptosis, involvement of neighboring organs; ulcer resulting in permanent ill health and often terminating in cancer.

In this chapter we choose to review the whole subject of those stomach operations which do not deal with malignant disease. Have not these operations for their purpose the relief of symptoms depending on ulcer? Authors have been in the habit of writing on the treatment of *hemorrhage*, *perforation*, *ulcer*, *hour-glass stomach*,

adhesions, and a variety of other conditions, as though such things were in themselves individual entities, — and they have so written, often greatly to the confusion of the reader. In order intelligently to discuss the subject of stomach surgery, one has to bear in mind the constant correlation of those conditions, and the dependence of them all upon ulcer. We shall deal severally with these various manifestations of ulcer, in the development of our theme, but we shall endeavor to do so while striving not to befog the reader's mind with a multitude of side issues.

If the preceding chapters have made their point, they have shown that in a considerable proportion of stomach cases relief must be sought through operation; but we are as yet far from asserting that the indications for operation are always clear. That is the difficulty of the situation, at present. In that our position is different from the firm ground on which we stand when dealing with appendicitis. All men now admit that appendicitis is a "surgical disease." In reaching that conclusion we passed through fire. So, too, with the question of operations on the bile passages. Every well-informed practitioner now turns to the thought of surgery when he is confronted with a case of gall-stones. We believe firmly that chronic gastric disorders should be subject to surgical consideration equally with cholelithiasis, and we anticipate that the time is not far distant when such will be the case, and by surgical consideration we do not necessarily mean operation.

When one consults the great volume of literature dealing with the surgery of gastric disease, and reflects on the immense amount of good work — no longer pioneer work

— already done, and regards the conclusions reached by thoughtful surgeons who have concerned themselves with the matter, one cannot but wonder at the reluctance, amounting often to blindness, of those practitioners who allow their patients afflicted with "chronic dyspepsia" to drag along in the old way. Happily, physicians and surgeons are now meeting on common ground, thanks to candor on the one side and much insistence on the other.

In certain respects it is peculiarly difficult, or impossible, to reach definite statistical conclusions regarding the problems of gastric surgery. The field is too recently tilled to permit of a long retrospect. Few end-results have been recorded; but clinical observations of cases have been so numerous, so remarkable often, and so convincing, that they form a strong chain of suggestive though circumstantial evidence. The opinions of such men as Kocher, v. Eiselsberg, v. Mikulicz, Hartmann, Robson, the Mayos, Bevan, Rodman, Fowler, Murphy, Munro, Deaver, and a host of others, call for the gravest consideration. Says Kocher:[1] —

"The majority of practitioners do not sufficiently realize what brilliant results are to be obtained by operative means in chronic affections of the stomach, commonly known as gastric catarrh.

"Not only can the numerous dangers of ulcerating affections of the stomach, such as hemorrhage, perforation, transition into cancer, be prevented, but the disease and its results may be so rapidly and certainly cured that the medical treatment of obstinate cases must be put in the background. . . .

[1] "Text-book of Operative Surgery," 1903, English edition, p. 199.

"The pain in the stomach disappears immediately after the operation. This is the invariable rule. . . . The patient does not require to pay any further attention to the nature of his food.

"The vomiting disappears.

"The bowels become regular.

"Repeated investigation of the gastric contents shows that there is a progressive improvement in the process of digestion; *hyperacidity diminishes; if too little acid is present, it becomes increased* [italics ours], a statement which is in agreement with Stendel, Carle, and Fantino, Kautsch, Hartmann, Soupault, and Mintz.

"The flow of bile into the stomach . . . has no deleterious influence either on the health of the patient or on the function of the stomach.[1] . . . Operative treatment of the results of ulceration is the true cure for this frequent and serious disease."

Gilbert Barling writes:[2] "In simple, uncomplicated stricture of the pylorus or some other part of the stomach (hour-glass contraction) the relief has been almost complete and thoroughly gratifying; the more severe the symptoms the more marked the benefit. If, as is not rarely the case (an important proviso), the patient has been markedly neurasthenic, the full benefit of the operation has been somewhat delayed, and subsequently, under stress of work or anxiety, a threatening of the old symptoms of pain and vomiting has arisen, due to gastric catarrh or to an easily exhausted nervous apparatus. With appropriate treatment these threatenings have passed off and the former condition of im-

[1] With this view Hartmann and Soupault agree.

[2] *Lancet*, May 10, 1904.

provement has been maintained." And even three years ago Barker [1] could say of seven cases of non-malignant pyloric stenosis, operated upon by posterior gastro-enterostomy, that all recovered, "and the change in health in those who had time to show it is most remarkable."

John Rogers, Jr.,[2] reporting five cases of gastric surgery, says: "In these five cases there was one death three weeks after operation, from an ascending infection of the urinary tract. But in none of them was there anything but satisfaction in the entire relief of symptoms. As they represented respectively cancer, dilated or atonic stomach, ulcer, chronic gastritis [and ulcer?] with hepatic cirrhosis, and benign stenosis of the pylorus, they can be said to be examples of successful treatment of nearly all kinds of chronic gastric disorders."

Here are some rather ancient notes of Hartmann;[3] he remarks that in gastric cases treated primarily by himself and his colleagues, the mortality was 2 per cent; while of those cases treated medically by other physicians and referred late to him, the mortality was 24 per cent. These notes are founded on an experience of sixty cases. He goes on to tell of the *end-results* in twenty-nine cases followed for from one to four years: —

Pylorectomy, one; well after eighteen months.

Gastropexy, one; well after two years.

Gastro-enterostomies, eighteen; well after two years, sixteen, while two were markedly relieved.

Eleven cases of the writer were operated upon during the past year, eight by Finney's method for pyloric

[1] *Ibid.*, Aug. 23, 1902. [2] *Annals of Surgery*, April, 1904.
[3] *Gazette Médicale de Paris*, Nov. 15, 1902.

stenosis, and three by gastro-enterostomy for ulcer. The time elapsed is short, but all the patients protest they feel well and can eat and digest normally.

Such evidence as is quoted above is neither final nor convincing. It is introduced here merely to show what is the feeling of surgeons regarding the outlook in this field. Some statistics and details will be considered later in this chapter.

As to the effect of these operations on stomach function, we have some information. Kocher's experience has been quoted.

In Hartmann's "Travaux de Chirurgie" for 1903, his colleague, Maurice Soupault, published some interesting observations on ten cases studied before and after gastro-enterostomy.

He found that there is no definite rule as to post-operative hypersecretion and hyperacidity in the fasting as compared with the digesting stomach, and he discusses three groups of cases illustrating these conditions. His conclusions are worth quoting: —

"Why are these differences? Several explanations may be given.

"First the reflux of bile and alkaline intestinal juices, when copious, may neutralize the gastric acidity in varying proportions according to their intensity.

"Second, the gastric evacuations through the new opening may take place more or less rapidly, according to the position and caliber of the anastomotic orifice. It is easy to conceive that the gastric secretions may be influenced in this manner.

"Third, the position and extent of the ulcer — the primary and necessary cause of the gastric hypersecre-

tion — appear to us also to be very important. We believe that the gastric juice is the result of a reflex, the point of departure of which is the irritation of the ulcer; and we believe that this reflex is the more considerable according as the lesion is more important and is situated in a less tolerant region.

"After the gastro-enterostomy it is probable that, at times, the ulcer remains isolated from the gastric contents and ceases to be irritated by such contact.

"In other cases it continues to be bathed, at least in part, by the liquids capable of irritating it, although to a less degree than before operation. One of the principal reasons which induces us to admit this theory . . . is that in patients upon whom a resection of the ulcer has been done the gastric chemistry has undergone important modifications, but very different from those modifications occurring after simple gastro-enterostomy."

With such reflections and considerations in mind, and admitting that certain cases demand operation, the surgeon asks himself and endeavors to answer the following two vital questions: —

When shall we operate?

What method shall we employ?

In order to answer these two questions, *when* and *how*, remember that chronic disease only, as a rule, demands surgical intervention. There are exceptions, for have we not already emphasized the necessity of operating in the case of acute perforating ulcer? It is chronic disease, however, that we shall consider here, — and some of the chronic conditions which we find calling for operation are: —

1. Ulcer.
2. Pyloric stenosis with gastrectasis.
3. Hemorrhage.
4. Distortion of the stomach (hour-glass).
5. Adhesions.
6. Multiple erosions.
7. Tetany.
8. Gastric cirrhosis.
9. Spasm of pylorus (Reichmann's disease).
10. Ptosis.

Several of these conditions are so frequently associated with each other, are so interdependent, and involve so often disease of other organs, that the internist and the surgeon constantly must be considering the possibility of such complications and be prepared even for difficult and extensive secondary operations.

Chronic Ulcer. — If chronic ulcer were a simple affair, confined to a localized area in the gastric mucosa, if it were single and uncomplicated, it would call for no special consideration in this book. Such an ulcer, if detected, could be cured by the measures of the internist, — by rest and careful feeding. But commonly chronic ulcer is a complicated affair, and it calls for the surgeon's intervention because it is complicated.

Its complications may be grouped under two headings: —

(*a*) Those which are induced by the active spread of the ulcer itself, — hyperchlorhydria, pyloric spasm, hemorrhage.

(*b*) Those which result from the ulcer's passive tendency to heal, — the complicating cicatrices, stenosis, distortions, adhesions, and the like.

So, commonly, the surgical writer, when he comes to the question of indications for operations on the stomach, is wont to seize upon certain consequences of gastric ulcer and explain that he operates for their relief; he operates on account of hemorrhage, distortions, tetany, etc.

This manner of writing is sometimes the result of inaccurate thinking and has led to constant confusion among readers, as well as to an almost hopeless chaos for the student when he attempts to unravel and classify statistics. For instance, those useful publications of Moynihan[1] and Joslin, Lund and Murphy,[2] purport to deal with definite groups of cases, which the writers pigeonhole under such titles as "Hemorrhage," "Chronic Ulcer," "Hour-glass Stomach," "Pyloric Obstruction," and the like. One can make no sharp distinctions in writing up the records, for hemorrhage may be associated with pyloric obstruction, and hour-glass stomach with both, while all three are part of the process of chronic ulcer.

Moreover, chronic ulcer itself may be mistaken for malignant disease even at operation, so that further confusion is thus introduced into the records.

Bearing in mind, then, that hemorrhage, adhesions, and gastrectasis are merely evidence of ulcer, and recognizing conversely that ulcer — active, latent, or cicatrized — is concerned with most of the non-malignant conditions for which we operate, let us take up these conditions severally and study our methods of treating them.

[1] "Surgical Treatment of Gastric and Duodenal Ulcers," 1903.

[2] *Boston Medical and Surgical Journal*, Aug. 4, 1904.

Pyloric Stenosis with Gastrectasis. — Certain aspects of this condition have been dealt with in our Chapter IV, and the fact has been pointed out that the vast majority of persons with dilated stomachs die shortly or remain chronic invalids. Of those persons who survive, the exact nature of their pyloric obstruction cannot always definitely be asserted; but since in this chapter we exclude cancer as a cause of the presumable obstruction, we can state that we are dealing here with a cicatricial stenosis from ulcer, with a high pylorus kinked by a short gastro-hepatic ligament, with a gastroptosis, or we are dealing with all three. Sometimes, too, there is the thickened non-malignant pylorus, in which no ulcer scar is found. Stenosis from ulcer, either healed or unhealed, is probably the commonest of these causes of dilatation; and in the sequence of events leading up to the symptoms we find established first an initial inflammatory condition, then a failure of proper drainage for the products of inflammation, then the superadded and inevitable presence of the normal secretions undrained, and finally of food undrained.

These conditions, by increasing the total amount to be drained, diminish the expulsive powers of the stomach, weaken its walls, and cause dilatation, with increased stasis. Furthermore, actual tissue changes going on at the same time, usually at the pyloric end of the stomach, result frequently in true organic stricture, through cicatricial contraction, — the attempt of nature to heal. Even if there be no organic stricture, a dilated stomach may sag and cause a kinking at the pylorus, — a kinking which may obstruct the outlet.

If this contracting process has not gone too far, lavage

and dieting may relieve the symptoms when there is no cicatrix closing the stomach's outlet; but often, when the patient with such symptoms presents himself, it is too late for any mild treatment. There is no resource save operation.

Stomach drainage is the operation indicated and it is imperative, — drainage from the stomach into the intestines. Methods of securing such drainage will be described shortly. The remote good results of operative treatment have been indicated already. What are the dangers attending the operation?

That is a question about which there has been the gravest discussion, and popular opinion in the profession is undetermined still. Surgical opinion is now fairly definite, however, and this divergence of estimates — the popular and the surgical — is due to lack of immediate knowledge on the part of medical practitioners. One cannot draw conclusions from the statistics of three or five years ago. Save for a few exceptional clinics, the work being done a few years ago was bad, from our present viewpoint. Experience in operating was small and technique was imperfect. Operations on the stomach and intestines are particularly careful work. They differ from ordinary surgery as much as the work of the woodsman differs from that of the tailor. In general terms routine operations on most parts of the body imply *destruction*. Stomach surgery implies *construction*. The hasty operator should have no part in such tasks. It requires a peculiarity of temperament, a nicety of touch, an exquisite care of detail, successfully to perform a pylorectomy, a gastro-enterostomy, or the operation of Finney, such as was not always acquired

by general surgeons a few years ago. Gradually and of late some few operators have perfected themselves in it, and to such men we owe it that in the past two years the mortality of these operations has fallen rapidly and is still falling; while from a comparison of experiences, old and new, and immediate results we are coming to perceive with added assurance that our end-results are to be increasingly good.

A further and important reason for our growing optimism is that we are treating to-day a less uniformly difficult class of cases than was brought to us a few years ago. A competent surgeon in dealing with a simple uncomplicated pyloric stenosis, not far advanced, in a patient still in fair health, should expect a cure. Even three years ago we had to do with patients exhausted by long illnesses, the victims of complicated and extensive lesions often impossible of mechanical improvement. Such patients came to us as a last resort; often they failed to leave the hospital alive; often our operations proved merely palliative or ineffectual. With such material to work upon, and against the proper conservative criticism of the profession, surgeons have been demonstrating their proposition that these disabilities are mechanical and demand mechanical remedies.

Gradually, we believe, the burden of proof has been shifted. Not long ago the internist said, Show us that these operations are essential, safe, and curative, and you shall have our patients. While now, in view of our growing array of facts and good work accomplished, the surgeon says, Show us reason for withholding from these patients the benefits of operation.

In the light of what we have said, then, let us examine a few figures, old and new, but with this proviso: there are *no figures* given that deal with simple obstruction dependent on ulcer no longer active. Ulcers are often multiple. Thinking no ulcer is present, one may operate for a stenosis when an undetected ulcer is there, either at the pylorus or elsewhere in the stomach.

Robson and Moynihan in their book on diseases of the stomach, edition of 1904, state of drainage operations that in the years 1881 to 1885 the mortality was 65.71 per cent; 1886 to 1890 the mortality was 47 per cent; 1891 to 1896 the mortality was 33.91 per cent, among all operators reporting all manner of cases. The Mayos [1] in 1902 reported eighty-nine gastro-jejunostomies in uncomplicated cases, with a mortality of 7.8 per cent; and 28 gastro-duodenostomies by Finney's method, with a mortality of 3.5 per cent. While Robson and Moynihan are able to state that of their last two hundred and eighteen operations for non-malignant disease the mortality was but 3.2 per cent.

In 1904 Finney reported to us by personal letter that in his own experience with the operation which goes by his name there were fifteen cases with one death, a mortality of 6.6 per cent.

In this same year of 1904 there were reported from Boston hospital records by Lund, Joslin, and Murphy a series of cases of pyloric obstruction, running over the five preceding years; twenty-one cases with five deaths, a mortality of 23.8 per cent. Even of those who recovered, four were not relieved and two came to secondary operations. But it is obvious in a study of the cases

[1] *Annals of Surgery*, June, 1903.

and with our present knowledge, that the technique of many of the operations was grievously at fault, nor are complicating conditions taken into account.

Of the older operations, Bevan says:[1] "An analysis of the cases demonstrates that here again gastro-enterostomy has won for itself the position of the operation of choice. It has supplanted Loretta's divulsion, the Heineke-Mikulicz pyloroplasty and pylorectomy. . . . The Heineke-Mikulicz pyloroplasty has been largely discarded because, in a considerable per cent of the cases, recurrence follows the rather brief relief of symptoms."

As one tries to sift out from the literature those cases in which pyloric stenosis is the important feature, one finds such figures as the following:—

In 1903 Moynihan[2] reported thirty-seven cases with no deaths. No end-results were obtained in eight of the cases, but twenty-nine were reported as perfectly well.

Robson and Moynihan reported further twenty-eight cases of obstruction operated upon, with four deaths. Twenty of the cases were found cured completely after from one to three years, while four were not heard from. An analysis of the cases shows that the four patients who died were extremely ill at the time of the operations.

Surprisingly interesting is a paper published in 1904 by Munro,[3] who reported in the most candid and courageous fashion a large series of cases with a high mortality. From a careful reading of his thoroughly

[1] *Journal American Medical Association*, Jan. 24, 1903.

[2] "The Surgical Treatment of Gastric and Duodenal Ulcers."

[3] *Boston Medical and Surgical Journal*, Aug. 11, 1904.

described work it is immediately obvious that he was dealing largely with desperately sick people, most of them sent to him as a last resort. Twenty-three of these operations were performed for non-malignant stenosis. Five patients died. Owing to the short lapse of time since the operations, he is able to show but five end-results. The remaining thirteen patients left the hospital well, however. In passing, one observes that five of Munro's cases were operated on by Finney's method, with a mortality of zero.

So we have recorded in this section the reports of a few men. Note the reports summarized in the following table; at the same time observe that the most unfavorable figures — those of the Boston hospitals, collected by Lund, Joslin, and Murphy — cover five years — pioneer years — and end with 1903; while Munro dealt with an unfavorable class of cases which he had the hardihood to report without excuse, save the graphic case-histories: —

RESULTS OF OPERATION FOR PYLORIC STENOSIS

167 Cases Collected from Sundry Clinics

	Operator	No Cases	Immediate Results		End-results		Mortality
			Good	Bad	Good	Bad	
1902	Barling . . .	7	7	0	7	0	0
1903	Mayo	28	27	1	27	1	3.5 %
1903	Moynihan . . .	37	37	0	29	8(?)	0
1903	Lund, Joslin, and Murphy collection .	21	12	4	9	7	23.8 %
1904	Robson and Moynihan	28	24	4	20	8	14.3 %
1904	Munro . . .	23	18	5	5+	?	21.7 %
1904	Finney . . .	15	14	1	14	1	6.6 %
1904	Mumford . . .	8	8	0	8	0	0
		167	147	15	119+	25±	8.9 %

We hope we do not insult the intelligence of the reader by observing it would be fatuous to suppose that this small collection of figures gives a fair estimate of the work now being done by all the surgeons quoted. Nor do we fail to recognize that one hundred and sixty-seven cases is a very small fraction in this field of work; but we are seeking end-results, and, at this writing, end-results have not been extensively reported. Those given are what we could obtain after a search of the most recent literature and some personal correspondence.

Fragmentary as the table is, it certainly bears out our contention that these operations are not especially dangerous, and that the end secured is good; while we have shown previously that without operation the great majority of such cases must look forward to lives of invalidism and to early death.

Hemorrhage. — There is the bleeding from acute ulcer, and there is the bleeding from chronic ulcer, the writers will tell you. But the affair is not so simple as that. Who is to say, always, what is acute ulcer, and what is chronic? There is the *acute* hemorrhage from *chronic* ulcer, which is sometimes spoken of as "acute bleeding ulcer."[1] It is well to bear in mind the following distinguishing facts: In acute ulcer, perforation is to be dreaded, in chronic ulcer, hemorrhage. While hemorrhage is sometimes alarming in acute ulcer, one need look for no permanent ill effects from it. There's the rub. For the hemorrhage may not be from an acute ulcer at all, but from a chronic ulcer, long unsuspected.

[1] See argument founded on this misapprehension, *Boston Medical and Surgical Journal*, Vol. CLI, p. 259, 1904.

However, for the sake of clinical convenience, we may say that the hemorrhage is from an *acute ulcer* when that hemorrhage is our *first intimation that an ulcer is present.* Such acute ulcer hemorrhage is venous usually. It may be profuse; it is nearly always transient. Do not operate for its relief. Under rest and dieting the bleeding will not recur and the ulcer will probably heal.

There are acute hemorrhages, however, which are far more serious matters, acute hemorrhages from *chronic ulcers.* Observe the types of hemorrhage from chronic ulcer. They depend on the progress of the ulcer and its seat: —

(*a*) Frequent slight hemorrhage, — venous or capillary oozing, — sapping vitality, leading to profound anæmia, often undetected for long, a very serious matter. For such bleeding you must operate and with assured hope of cure.

(*b*) Intermittent hemorrhage, of considerable quantity, probably from a small eroded artery. This never ends with fatal bleeding, but the patient is apt to become profoundly depressed. Gastro-enterostomy for drainage is here indicated. The bleeding ceases, and the ulcer, no longer irritated, gradually heals.

(*c*) Acute and profuse hemorrhage associated with pronounced gastric symptoms, — pain, vomiting, — soon repeated. Such profuse hemorrhage may kill.

A fourth variety of hemorrhage is talked about, though, indeed, it is but an exaggeration of type (*c*). Moynihan describes it thus: —

(*d*) "The hemorrhage is instant, overwhelming, lethal."

In the case of pronounced and recurring dangerous hemorrhage, gastro-enterostomy must be our sheet anchor. If we can so operate in an interval between bleedings, we may look for a cure. Do not explore the stomach and seek to excise the ulcer. Gastro-enterostomy is enough.

On the other hand, any operation performed upon the stomach during or immediately after a severe and exhausting hemorrhage is very likely to prove fatal.

When we reflect that about 8 per cent of all gastric ulcer cases end in death from hemorrhage, by so much is force added to the surgeon's urgent advice that all such ulcers which do not yield promptly to the internist's treatment should be treated by gastro-enterostomy.

The writers have found it impossible to collect a large array of figures illustrating the results of operations for hemorrhage; moreover, the few authorities to be quoted use the term "hemorrhage" in various senses. From a careful reading of the cases of Robson and Moynihan it is obvious that when they perform a stomach operation upon a patient who has recently had hæmatemesis or melena, they list the operation as done for hemorrhage. Accordingly, their results are good when they operate for hemorrhage, for they operate properly in the interval. On the other hand, Munro and the reporters for the Boston hospitals mean by hemorrhage active present bleeding, or bleeding but just ceased. So their reported results are bad. Scattered reports from numerous surgeons teach conclusively the lesson that emergency operations to check violent gastric hemorrhage almost always end disastrously.

In this connection it is interesting to point out to our *confrères*, not surgeons, that individuals who control great clinics — such men as are Robson in England, v. Mikulicz in Germany, Kocher and Roux in Switzerland, the brothers Mayo in America, and a few such others — have opportunities for seeing cases early, for following them, and for electing the time for operation, — such opportunities as, up to the present, have not been vouchsafed to the great majority of operators.

If a surgeon sees his case for the first time, when the patient is blanched and prostrated with recent hemorrhage, and an operation is urged by the internist as a last life-saving measure, it is obvious that a grievous responsibility is laid upon the operator, who enters upon his task with the almost certain knowledge that his endeavors will prove futile.

Consider the following statements: —

1. Robson and Moynihan, in 1901, reported twelve cases of hemorrhage from ulcer operated upon by gastro-enterostomy. *Eleven* recovered and one died, — a mortality of 8.3 per cent.

2. Rodman, in 1902, collected thirteen similar cases; three died, — a mortality of 23 per cent.

3. Moynihan, in 1903, published other twelve cases, of which one died, and that one not subjected to gastro-enterostomy, but to excision of the ulcer, — a mortality of 8.3 per cent.

A careful review of the twenty-four cases of the English surgeons, cases serious and more or less complicated, demonstrates that mostly they were not urgent, but were proper operative risks.

On the other hand, Munro, in 1904, reported faithfully

his eight desperate cases. *Seven* died and one recovered, — a mortality of 87.5 per cent, while Lund, Joslin, and Murphy, in 1904, presented us with report of ten cases gleaned in five years from the Boston City and Massachusetts General hospitals, — ten cases with a mortality of 100 per cent.

Such facts call for no further explanation. The last compilers remark tersely, "Surgical intervention in gastric hemorrhage should be considered even before it is urgent, and the surgeon should jointly with the physician watch the course of the patient."

In other words, simple drainage operations done for bleeding gastric ulcer, but done when the patient is in fair condition, usually will result in cure.

Surgical opinion has become nearly unanimous that in almost all such cases the operation of choice is gastro-enterostomy. Excision of the ulcer, infolding of the ulcer, or attempts to tie the vessel are unsatisfactory procedures, for the ulcers may be multiple, the process may not be checked, and the vessels may not be found. Gastro-enterostomy in itself shows a low mortality, and it generally cures the underlying process.

Distortion of the Stomach. — We prefer this phrase to "hour-glass stomach." The latter term is sanctioned by usage, but it is frequently inappropriate and represents only a fraction of the stomach deformities caused by advanced ulcer. In Chapter V we had some words to say of the nature of hour-glass stomach; and what we said there applies practically to most distortions of the stomach which tie it up or locally constrict its caliber, and so diminish its motility.

Of course, the purpose of surgery — for here, obviously,

medicine will not avail — is to free the stomach from crippling adhesions and to restore its lumen approximately to the normal. Fortunately, this can be done (1) by fairly simple operative measures, in which the isolated gastric pockets may be brought together and an anastomosis made between them. The result is not a stomach reconstructed on normal lines, but a series of freely communicating and easily draining pouches.

Our personal choice is (2) a gastro-plasty, when possible, done after the manner of Finney's gastro-pyloro-duodenostomy. In the one case, operated upon in April, 1904, in which we have used this method, the result was satisfactory anatomically and symptomatically.

(3) Gastro-enterostomy is a poor substitute for the two previous operations unless one is dealing with a coincident pyloric stenosis or with active ulcer. Anastomoses should be made between the jejunum and each individual stomach pocket.

Partial gastrectomy should be our resort only in case of such extensive crippling and distortion of the stomach as render impossible the other operations.

A careful reading of the recent surgical literature shows that these operations for distortion are somewhat more hazardous than are those for uncomplicated pyloric stenosis. Obviously this must be so, for distortions of the stomach imply long-standing disease and frequent complications. One may find more or less extensive adhesions and involvement even of other organs in the inflammatory process.

Scattered through the journals there are to be found

reports of cases of stomach distortion, but there are few groups of statistics. In 1901 Robson and Moynihan collected all the cases which had been reported up to that time. We give them in the following table, together with three cases reported by the Mayos and thirty-four reported personally by Robson and Moynihan : —

OPERATIONS FOR DISTORTIONS OF THE STOMACH

(Hour-glass Constriction)

		Cases	Immediate Results		End-results		Mortality
			Good	Bad	Good	Bad	
1889–1901	All cases . . .	33	23	10	21	2	30.3%
1901	Robson and Moynihan	18	17	1	17	0	5.5%
1903	Mayos	3	2	1	2	0	33.3%
1903	Moynihan . . .	16	13	3	13	0	18.7%
		70	55	15	53	2	21.4%

These are figures which do not represent the work of one man, or one group of men. Twenty-five operators contributed the statistics, and even so the total mortality cannot be called excessive. As is the case with other types of operations which we have studied, clinical experience is showing that we are constantly improving over such printed reports as are given in the above table, and it is a striking fact that a majority of the patients who recovered are stated to have remained well, — fifty-three out of fifty-five immediate recoveries.

Adhesions. — Perigastric adhesions form probably the most common complications or results of gastric ulcer. Fenwick states that adhesions are found at autopsy in 42.5 per cent, or nearly half of the ulcer cases. In those

cases which come to post mortem this is doubtless true, but we do not believe it is true of all cases of gastric ulcer. However that may be, the condition is common, and merits the earnest consideration of internist and surgeon.

Of all the complications of ulcer, adhesions are perhaps the most difficult to make out before abdominal exploration; yet the condition often is extremely distressing and serious. The patient will tell of indefinite discomfort, eructations, pain, distress; but the symptoms vary according to the seat and extent of the adhesions. If the adhesions are near the pylorus, one observes all the indications of a pyloric stenosis; if they are in the fundus, one may have to deal with an actual hour-glass constriction and its accompanying symptoms; if they are near the cardia, one may see difficulty in swallowing, vomiting soon after eating, and great malnutrition; while in all cases adhesions may affect neighboring organs and cripple their functions.

In the case of adhesions it is not to be expected that anything short of a successful operation will bring lasting relief, especially as the conditions are frequently associated with other permanent lesions within the stomach itself. If the adhesions admit of a simple gastrolysis, or separation of surfaces, the patient is fortunate. When the conditions demand no more than that, a cure often is established.

There is the danger of the re-formation of adhesions, though this does not necessarily always follow, nor do fresh adhesions always bring back with them the old symptoms. If the separated raw surfaces are extensive, and if recurrence is dreaded, the surgeon may

interpose, to advantage, Cargile's membrane or omental grafts.

From the operator's point of view the most serious adhesions are those which cannot be separated without extensive laceration of organs or the breaking down of fistulæ already established. Such cases must be handled according to one's individual judgment. Often in such cases it will be thought wise to leave the adhesions undisturbed, and to attempt restoration of gastric function by some drainage operation, such as gastro-jejunostomy.

Erosions. — The absolute frequency of erosions is not ascertained, for they cannot be determined except by exploration of the stomach. Doubtless confusion arises frequently. Erosions may be taken for a bleeding chronic ulcer, when the evidence of hemorrhage with hyperchlorhydria and a certain amount of pain may mislead one as to the true condition.

In most cases, if there be no stenosis, erosions will disappear under rest, dieting, and the use of bismuth in large quantities, — at least we must so assume if we can make the diagnosis. Certain of the cases of erosions persist, however, and may be cured by appropriate drainage through gastro-enterostomy. Physicians ask, How long shall we wait before resorting to such surgery? A year, unless the patient's failure is so rapid as to make radical measures imperative.

From time to time surgeons report that they save cases of active hemorrhage by operating while bleeding is going on, — that they find a stomach half full of blood. Commonly, in such a case they are dealing with erosions, — quite a different matter from opening the stomach in

the case of acute arterial hemorrhage. Usually one will cure erosions by gastro-enterostomy, while the victim of an actively bleeding vessel is likely to die.

Gastric Tetany. — In every case of tetany one should think of the possibility of pyloric obstruction. In children we see convulsions associated with gastro-intestinal disturbances; in adults organic stomach disease is one cause of tetany. It is only since Kussmaul's observations, in 1869, that we have recognized a relation between gastric disease and tetany, but we are now coming to believe that gastric tetany is not so uncommon as was supposed.

It is needless here to detail the symptoms, which run all the way from a numbness and tingling to spasms affecting many groups of muscles. The attack may end with death in coma.

Usually gastric dilatation is the coincident causative condition in tetany, the spasms being due, probably, to the absorption of some poison from the dilated stomach, with an associated painful contraction of the pylorus.

Obviously stomach lavage is indicated for relief, and sometimes lavage can be accomplished; but unfortunately it has been found that attempts to pass the tube may bring on convulsions and closure of the pharynx, making the procedure impossible.

So, under medical treatment, the disease has had a high mortality. Moynihan[1] refers to a collection of one hundred and one cases with a mortality of 64.35 per cent without operative treatment, and he points out the value of drainage by gastro-enterostomy as the only logical resource.

[1] *Boston Medical and Surgical Journal*, Nov. 5, 1903.

Cunningham[1] relates in detail an important case in a young man of twenty-eight, who had been the victim of stomach disease for eight years. Refusing operation, he was observed from time to time at the Boston City Hospital for two years. He had several attacks of tetany, became greatly reduced, and finally, in wretched condition, was operated on as an emergency case by Watson. He recovered and five months later, at the time of the report, was well, stating, "I was never so well in my life." That case is an admirable illustration of gastric tetany, and the result of investigation of such conditions shows that they are always dangerous, with a high mortality under palliative treatment; but that, given a fair chance, as in this instance, stomach drainage cures.

Gastric Cirrhosis. — This rare condition must be mentioned merely in passing. Sheldon[2] has collected eleven reported cases and sums up in an interesting paper what is known of the subject. The disease is chronic, and does not appear to be associated with ulcer or cancer. The stomach wall is found thickened, often scarred and stenosed, and the symptoms resemble those of long-standing ulcer, except that the vomiting is small in amount.

Of the first ten cases collected by Sheldon, all died unrelieved. The eleventh, his own case, after years of invalidism and having suffered much at the hands of many physicians, was cured by Sheldon's gastro-enterostomy. The rationale does not appear at once, but the success of the procedure seems undoubted.

Spasm of the pylorus (Reichmann's disease), not

[1] John H. Cunningham, Jr., *Annals of Surgery*, April, 1904.

[2] John G. Sheldon, *Annals of Surgery*, March, 1904.

associated with pathological changes, is a condition occasionally seen. It is said to be due to gastric hyperchlorhydria, but this is not always proven. Formerly Loreta's operation of stretching the pylorus was done for relief of the condition, until it was proved unsatisfactory. The symptoms are those of obstruction. In such case again, if lavage, dieting, and faradism fail to cure, gastric drainage is indicated; and we regard the pyloroplasty of Finney as the most rational procedure.

Gastroptosis will be considered at length in a subsequent chapter. Suffice it here to observe that prolapse of the stomach is common. Frequently seen in connection with ptoses of other organs, it is seen especially associated with gastric dilatation. Again, gastroptosis, by dragging on the fixed pylorus, may itself, through the resulting kinking of the pylorus, cause stenosis and gastrectasis. Beyer's operation of reefing the gastrohepatic omentum has been found to correct the deformity and relieve symptoms, while an independent or supplementary gastro-enterostomy is also a useful procedure.

We have ourselves, in a case of gastroptosis with dilatation, practised Finney's pyloroplasty with resulting relief of symptoms.

Such is a detail of some of the more common manifestations of gastric ulcer for which the surgeon operates; let us ask ourselves, What conclusions may we draw from the work so far accomplished? What are the patient's prospects? Are we satisfied with our end-results? What shall we answer the internist dealing with a case of obstinate chronic dyspepsia or pronounced

ulcer when he asks how soon he is to seek surgical aid? These are pertinent questions to-day.

Briefly then: we believe that the problem is being solved rapidly, though the end is not yet. Chronic gastric ulcers, with their numerous sequelæ, are being relieved and, it is hoped, cured by the surgeon. A considerable proportion are but little relieved, and a few die. Whether ulcer be the result of local necrosis, of trauma, of infection, or of an underlying systemic condition, the fact remains beyond peradventure that stomach drainage does put the ulcer at rest, does promote healing, and does render improbable a recurrence of ulcer.

Then our medical consultants will tell us, "All very true, but there are cases in which we have followed your advice, the operation has been done, and behold, the last condition is worse than the first." Here is an example of that very thing, with the explanation: —

In the winter of 1903–4 a well-known internist studied a series of cases of impaired gastric motility; he made up his mind that the symptoms present were due to a slight pyloric obstruction, without active ulceration, and he sent the patients to a local hospital for operation. His estimate of the conditions was verified. A few months later four of these cases, having been subjected to operation, again came under his care. All had a continuance of their old symptoms; some were worse than before. But what operations were done? we ask. Simple gastro-jejunostomy with the long loop in all.

No wonder the symptoms recurred. Under the conditions found, — a pylorus partly open, — what could have been more fatuous than such a simple gastro-

jejunostomy? The stomach was left with two openings; and when the new drainage was established through the anastomosis, the pyloric irritation subsided in part; then all stomach contents passed the natural way; the artificial opening closed, wholly or in part; the original lesion gradually became reëstablished, and the symptoms recurred. We know now that this often is what happens. Simple gastro-enterostomy in such cases is not the proper operation. The pyloroplasty of Finney would have resulted in cures; so would gastro-enterostomy with entero-enterostomy and section of the pylorus; so would pylorectomy. To-day such a series of bad results as we have described would not occur in the clinic of a surgeon familiar with these operations.

It is argued by sundry zealous surgeons, enthusiasts for this branch of work, that internists are too conservative, are too critical, loath to abandon their own measures, sceptical of what surgery may accomplish. It is pointed out by such surgeons that an analogy with the present discussion is seen in the long dispute over appendicitis and over disease of the bile passages, — indeed, we ourselves may have seemed to use that argument. Such statements on the part of surgeons are not entirely just. Progressive *internists* are no longer sceptical, — indeed, some are almost too credulous. All of them are asking for light, for further information. In one respect, however, we believe that many *general practitioners* err. They call in the surgeon when they think an operation should be done. They should call him before that, — not to do the operation which they have decided upon, but to watch the case with them, to help in the decision as to the exact time and nature of the

operation. That is where the analogy with appendicitis applies. The surgeon is consulted in every case of appendicitis. Often he decides against operation; but the responsibility is shared with the physician. In calling the surgeon the latter has discharged his duty.

And with reference to gastric disorders; if the case is obstinate, chronic, obscure, as soon as the physician has made up his mind that here is not a simple affair, easily remedied, but one in which surgery may some day have to intervene, then is the time for a consultation. Thus will physician and surgeon alike advance their education. The time for operation may be after a day; it may be after a month. Indeed, the question rarely is one of time alone.

We admit that the analogy between stomach surgery and surgery of the bile passages is fairly enough drawn, — indeed, the two overlap and run into each other; but between the appendix and the stomach, the comparison is not so obvious. Though sometimes difficult and calling for good judgment, surgery of the appendix is easy compared with gastric surgery. In the case of appendicitis, the indications for operation are more certain and special procedures more definite. On this point we shall express an opinion.

Such, in outline, is the situation as it appears to-day. We are aware that even as we go to press, new figures and more satisfactory statistics are being prepared; but we hope we have said enough to show that progress is being made, and that the future of gastric surgery is important, broad, and promising.

Some of the procedures and the technique of operations upon the stomach will now be studied.

Gastric surgery is twenty-five years old, but for the first fifteen years its advance was halting and unsatisfactory. So long ago as 1880, von Mikulicz sutured a perforation on the lesser curvature of the stomach, but the patient died. In 1881 Rydygier excised successfully an ulcer. In that same year Wölfler devised and performed the first gastro-enterostomy. That was an anterior gastro-jejunostomy, and was done for cancer. But it was not until 1893 that drainage operations for the relief of ulcer were introduced, and it is to Doyen that we owe this important advance. Since then the scope and value of these operations for all sorts of stomach derangements have developed rapidly, and a multitude of modifications have been introduced, some of the most important of which we propose to sketch.

Preliminary treatment of the patient is dealt with at length by sundry writers, but in our opinion extensive treatment generally is needless in non-malignant cases. Unless the stomach be greatly dilated and foul, no more than one or two washings are called for. Careful antiseptic cleansing of the mouth and throat is important, as well as proper stimulation and support of the patient by nutrient enemata and other appropriate methods.

After stomach operations, too, the excessive care in feeding practised a few years ago has been proved superfluous. Water may be given as soon as the vomiting and nausea cease, and we find that the post-operative vomiting usually is not severe. Liquid food may be given after twenty-four hours, soft-solid food on the third day, and a moderate full diet at the end of a week, if all has gone well.

It is advisable to keep the patients well propped up

on pillows for the first week. Pressure upon the fresh lines of suture is thus relieved, and convalescence seems to progress more evenly and rapidly.

We advocate more frequent and earlier exploratory operations. This is a familiar proposition to surgeons. Explorations used to be made as a last resort, to see if by chance something might not be done to remedy an almost hopeless condition, and generally nothing could be done. On the contrary, we should explore to make the diagnosis, not to confirm it, and we should then proceed in accordance with our findings. The old desperate exploration was for the most part useless, and often ended fatally. The proper modern exploration has a very low mortality. When nothing further can be done, W. J. Mayo wisely advises a quick sewing up, with buried silver sutures, of the short two-inch wound, and getting the patient out of bed in a week. The sutures hold and the patient usually avoids the danger of becoming bedridden.

In general terms there are two methods commonly used for stomach drainage: posterior gastro-jejunostomy, and anterior gastro-jejunostomy, with their various modifications. Recent text-books on operative surgery describe in great detail these procedures, so that it does not seem in place for us to weary the reader with an elaborate dissertation on the subject. We shall rehearse the procedures briefly, however, describe among others three operations which we favor especially, and discuss methods of meeting particular conditions.

I. When circumstances permit, we recommend the posterior gastro-jejunostomy as advocated by Moynihan.

which, whether with or without the button, is also essentially that of Kocher, von Mikulicz, and Czerny, as detailed by Peterson. Scudder[1] has described this operation for American readers, and has done so in admirable, concise, and lucid fashion. We take the liberty of using his words in our account: —

"The preliminary preparation of the patient, the isolation of the operative field, the selection of the place in the stomach and the intestine for the anastomosis, the use of rubber-covered clamps, the rapidity of suture without the use of needle holder, the employment of relatively large needles, the use of the Pagenstecher linen thread, the very careful attention to every step, absolute cleanliness, absolute hæmostasis, — these are the details which mark a new era in the development of the technique of gastro-enterostomy.

"It is coming to be recognized . . . that the nearer to the origin of the jejunum the anastomosis with the stomach is made, the more satisfactory is the convalescence and subsequent course of any individual case [Fig. 2].

"The technique of posterior gastro-jejunostomy as I am doing it to-day, without a loop, is as follows: an ample incision is made through the middle of the belly of the right rectus abdominis muscle. . . . Upon opening the abdomen the duodenum and the *whole* of the stomach should be examined carefully in order to detect possible lesions. . . .

"The great omentum and transverse colon are lifted completely out of the wound at the upper angle of the wound, and placed upon a sterile towel covering the sterile

[1] C. L. Scudder, *Annals of Surgery*, September, 1904.

abdominal skin, thus exposing the under surface of the transverse mesocolon. While the left hand grasps the transverse colon and omentum, the fingers of the left hand push the posterior wall of the stomach *in its pyloric*

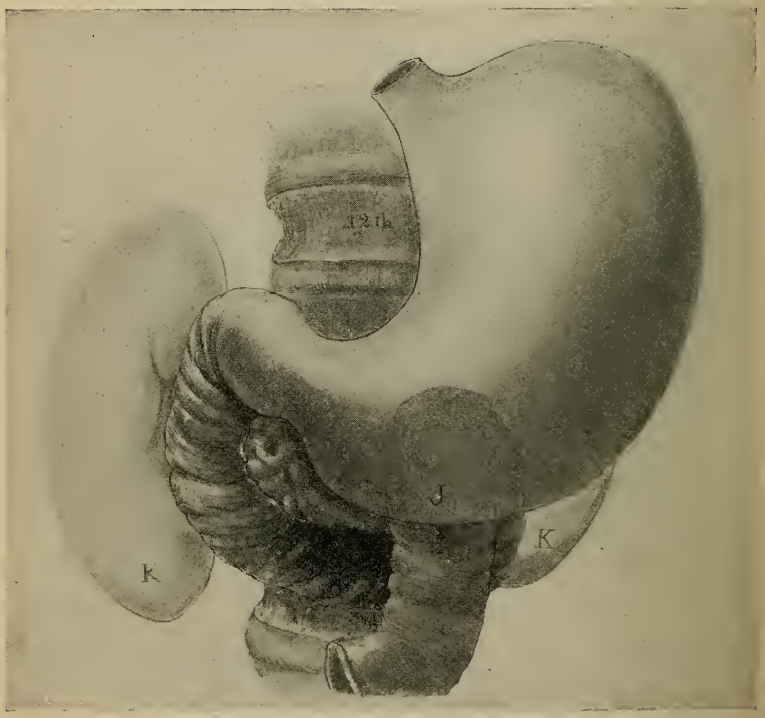

FIG. 2. — To show the relation of the beginning of the jejunum to the posterior wall of the stomach under normal conditions.

Note the tortuous course of the duodenum. Note that the natural place for the anastomosis between stomach and jejunum is where the jejunum rests against the posterior gastric wall.

(After Scudder, in *Annals of Surgery*.)

portion [italics ours] firmly against the meso-colon [Fig. 3]. The right hand incises with a knife (or tears) the transverse mesocolon, thus exposing the posterior wall of the stomach.

"This incision is so placed that large vessels are

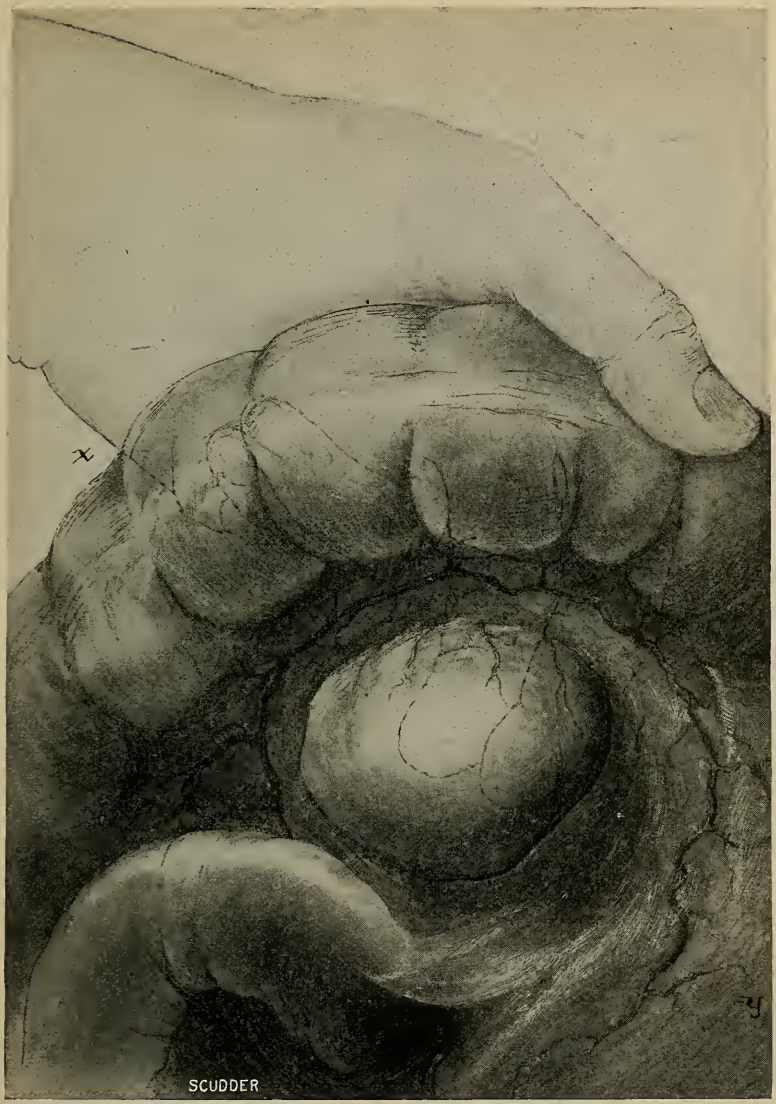

FIG. 3. — To show the beginning of the jejunum and the peritoneal fold above the superior mesenteric vessel. To show the method of grasping with the left hand the transverse colon and the pushing the posterior stomach wall through the small rent made in the transverse mesocolon. The colic vessels supplying the colon are shown, as well as the vessels of the greater curvature of the stomach.

The omentum is purposely omitted from the drawing.

A line connecting the two points x and y indicates the best angle at which to apply the clamp to the stomach.

(After Scudder, *Annals of Surgery*.)

avoided. Its direction is at right angles to the transverse colon's long axis. . . . The opening in the mesocolon should be four or five inches long. . . . The large colic vessel which nourishes the transverse mesocolon should of course be carefully avoided.

"The posterior wall of the stomach is picked up by two pairs of dissecting toothed forceps, thus freeing it from the anterior wall of the stomach which is being pressed against it, and the stomach clamp . . . is applied. The clamp should be placed so as to avoid including, as far as possible, many large vessels. It must be remembered, however, that the large vessels mark the lowest border of the greater curvature of the stomach. . . . The clamp is placed a little obliquely upon the stomach in the line joining *X* and *Y* [Fig. 3].

"This oblique position is advantageous, according to Moynihan, for upon replacing the stomach and jejunum in the abdominal cavity after the anastomosis is completed, the incision in the stomach lies most naturally against the jejunal incision without undue traction. The beginning of the jejunum is next sought a little to the left of the spinal column and at the attachment of the transverse mesocolon. The jejunum is picked up by two pairs of toothed forceps, placed opposite the mesenteric attachment, at that distance from the peritoneal fold, marking the beginning of the jejunum, which is suitable to the case in hand. The nearer to the beginning of the jejunum the anastomosis can be made, the more satisfactory will be the result. The clamp is placed longitudinally upon the jejunum opposite to the mesenteric border. The anastomosis is made so that the peristaltic movement of the jejunum occurs

in the same direction as the peristaltic movement of the stomach. The clamps upon the stomach and upon the jejunum are placed alongside of each other, thus bringing the parts of the stomach and jejunum to be anastomosed into close apposition, entirely outside the abdominal cavity.

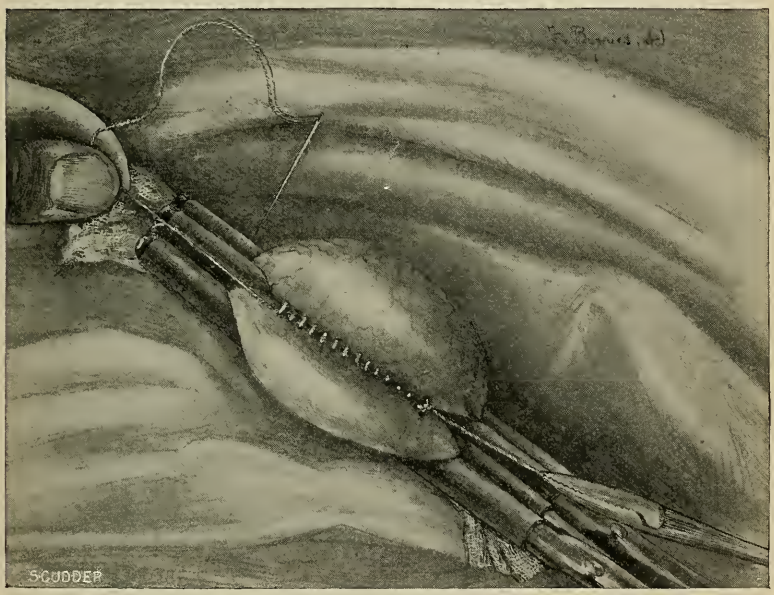

Fig. 4. — To show the clamps applied to the stomach above and to the jejunum below. Note the angle at which clamps are applied. Note the strip of gauze between clamps posteriorly. Note the first half of the peritoneal suture being taken. Note that the suture is not drawn as tightly as usual in order that it may be seen in the drawing.
(After Scudder, *Annals of Surgery*.)

"The omentum and transverse colon are now, if possible, replaced within the abdomen.

"The first, or peritoneal, suture is now taken with curved needle and No. 3 Pagenstecher linen thread. The suture is started at a point farthest from the surgeon and is made toward the surgeon. The sutures include

peritoneum and muscular coats. The Cushing suture is used. The initial end of the suture is left long. The curved needle is of such a size that it may with ease be

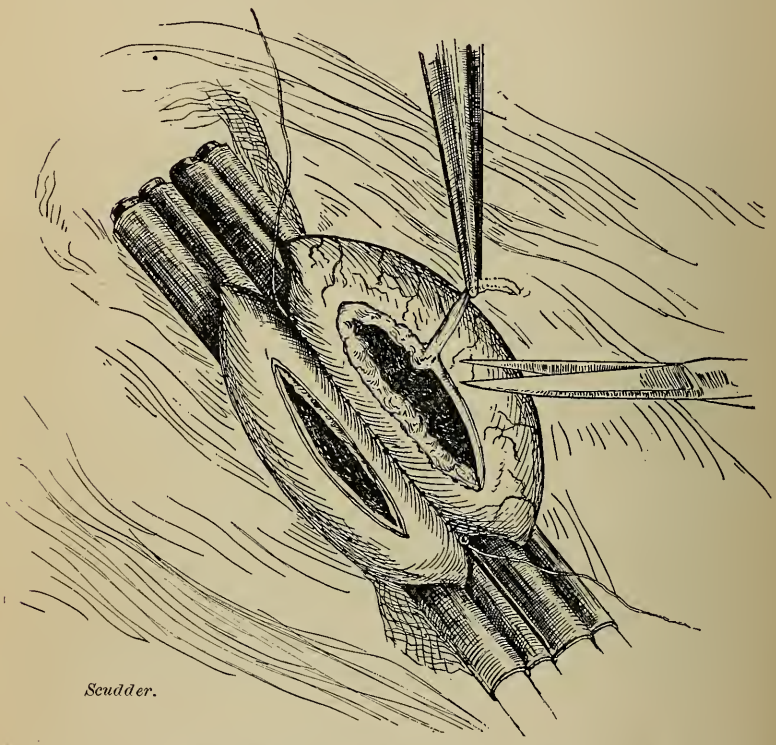

FIG. 5. — To show the removal by scissors of the prolapsed mucous membrane of the stomach, after the incisions into the stomach and intestine. Note that the mucous membrane from the jejunal opening has been already removed. Note that enough is removed to make the peritoneum and mucous membrane level. The first half of the peritoneal suture is shown completed. The gut is seen grasped by the clamps at the mid-portions of the blades of the clamps to secure evenness of pressure.

(After Scudder, *Annals of Surgery*.)

used without a needle-holder. . . . Having completed the first half of the peritoneal suture, the thread is left long [Fig. 4]. . . .

"The stomach and jejunum are next opened by a

knife incision parallel with the line of suture just completed. The incision in the jejunum is therefore a longitudinal one. (The transverse incision of Mikulicz and Kocher limits the size of the opening.) The incisions are placed about one-half inch from the line of peritoneal suture. . . . The size of the open-

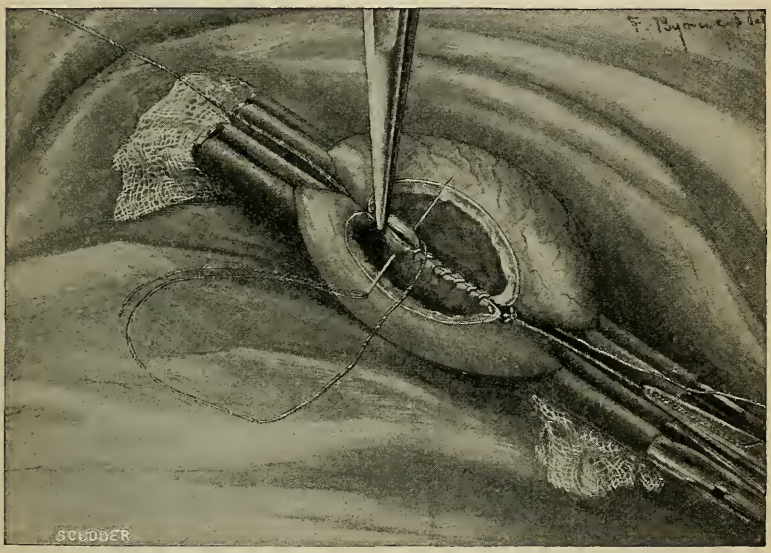

Fig. 6. — To show the taking of the first half of the through-and-through or hæmostatic suture.

Note at the beginning that a seroserous suture is taken and tied, that then the needle passes into the gut and then through and through all layers of both intestine and stomach walls. It is an over-and-over, through-and-through continuous suture.

(After Scudder, *Annals of Surgery*.)

ing made will depend upon the physical conditions present. An opening of from two and one-half to three inches is ordinarily needed. Intestinal contents and stomach contents are carefully removed by tiny gauze sponges at hand for this purpose. . . . The prolapsed mucous membrane of both the stomach and the jejunum is excised . . . by means of scissors

so that the mucous membrane is level with the peritoneum [Fig. 5]. . . .

"The first half of the second suture is now taken with a straight No. 6 milliner's needle and No. 3 Pagenstecher thread. . . . This suture is begun by taking a peritoneal and muscular stitch through both stomach and

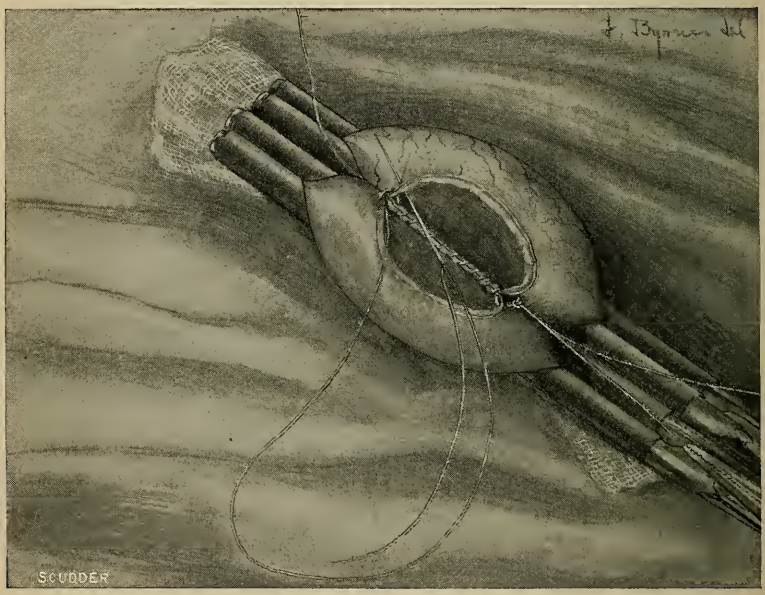

FIG. 7. — To show the second half of the second or through-and-through suture. The needle passes always from mucous membrane to peritoneum on one side to peritoneum and mucous membrane upon the other side, and then the peritoneal surfaces are always brought into apposition. Note the needle is beginning the return suture.

(After Scudder, *Annals of Surgery*.)

intestine [Fig. 6]. The needle is then carried into the lumen of the bowel and through and through all coats of both jejunum and stomach in an over-and-over continuous suture ; . . . upon reaching the end of this suture the needle is carried out from the lumen of the bowel through the peritoneum and tied to the initial peritoneal

stitch. Thus peritoneal surfaces are brought into close contact throughout this whole suture. . . .

"Both clamps are now loosened. One of the clamps is removed. The other is left in place but open, as sug-

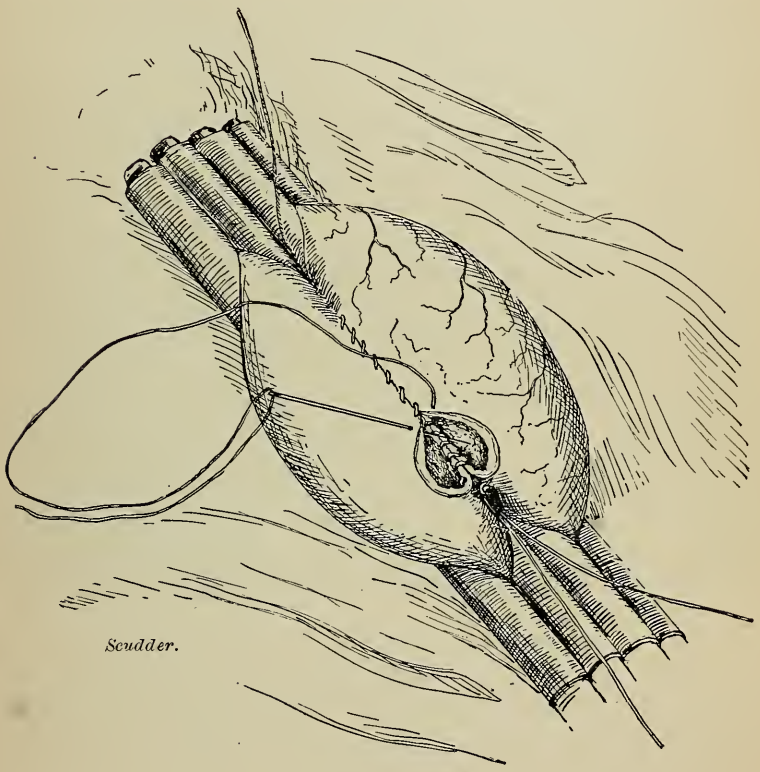

FIG. 8. — To show the completion of the second half of the through-and-through suture. Note how the opening has been gradually closing. Note the needle finishing the stitch. Note that, to finish suture ideally, the needle passes through peritoneum last, and is then tied to the first peritoneal suture used at the starting place. See figure. Thus peritoneal surfaces are brought into contact.
(After Scudder, *Annals of Surgery*.)

gested by Munro, that it may serve as a shelf upon which the bowel and stomach may rest and not slump into the abdominal cavity. . . . The lumen of the gut

and stomach are now closed [Figs. 7 and 8], and all possibility of soiling the peritoneal surfaces being eliminated, the whole region should be wiped with sponges wet with hot salt solution. . . .

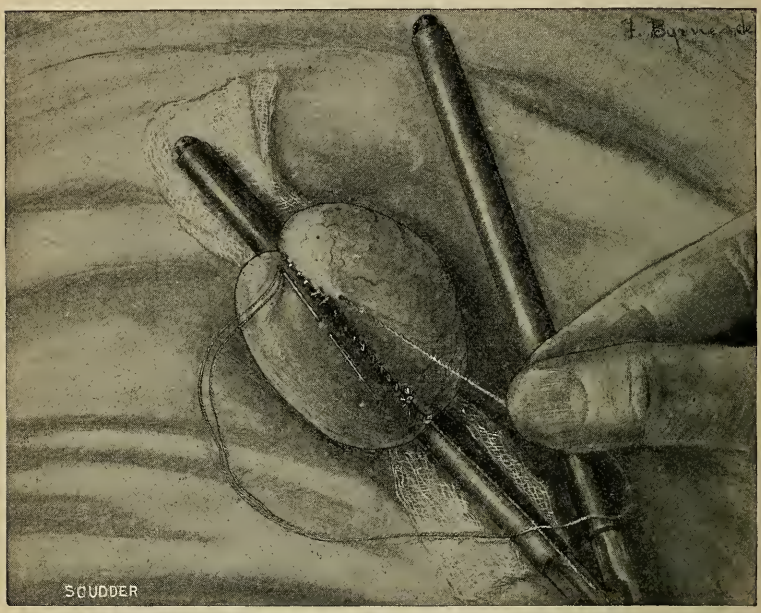

FIG. 9. — To show the second or through-and-through suture completed. To show the second half of the first or peritoneal Cushing suture. Note that the clamp upon the jejunum has been removed. Note that the clamp upon the stomach has been loosened, but that one blade has been retained to serve as a shelf to hold the part well without the abdomen, and thus to prevent slumping of the part until the suture is completed and the parts are cleansed finally.
(After Scudder, *Annals of Surgery*.)

"The second part of the peritoneal stitch is now complete [Fig. 9]. The whole field of operation being absolutely clean, the edges of the opening in the mesocolon are sutured to the posterior wall of the stomach in two or three places. . . . This prevents contraction of the opening and consequent subsequent constriction of the gut. This suture also prevents a hernia of the small

intestine into the lesser cavity of the omentum. . . . The distal portion of the jejunum is now replaced in its natural position, whatever this may be in the individual instance; usually it is to the right of the spine. The omentum is replaced, covering all. The abdominal wound is closed."

We have described this operation in Scudder's words, because he has covered the minutiæ of the technique more faithfully than other writers, and because much of what he says applies equally to other operations at which we must glance.

To the foregoing operation is applied the much-talked-of principle of the "short loop"; more properly there is no loop [Fig. 10].

The operation with the "short loop" has now been used by a number of surgeons in a large number of cases. Physiologically it appears to approximate the normal conditions. The anastomosis is made opposite the second lumbar vertebra close (two to six inches) to the beginning of the jejunum, where it curls forward in normal approximation to the stomach, and that low portion of the stomach, near the pyloric area. So long ago as 1903 Trendel[1] reported a very satisfactory series of cases from the clinics of Czerny, Steinthal, Bruns, and himself, operated upon by the short loop method.

Trendel's series includes a large number of cancer cases, but even so the deaths in the total of two hundred and sixty-nine cases were only forty-nine, or 18.3 per cent. The interesting and significant fact about the series, however, is that in not a single case was there established a true vicious circle.

[1] *Beit. Klin. Chir.*, 1903.

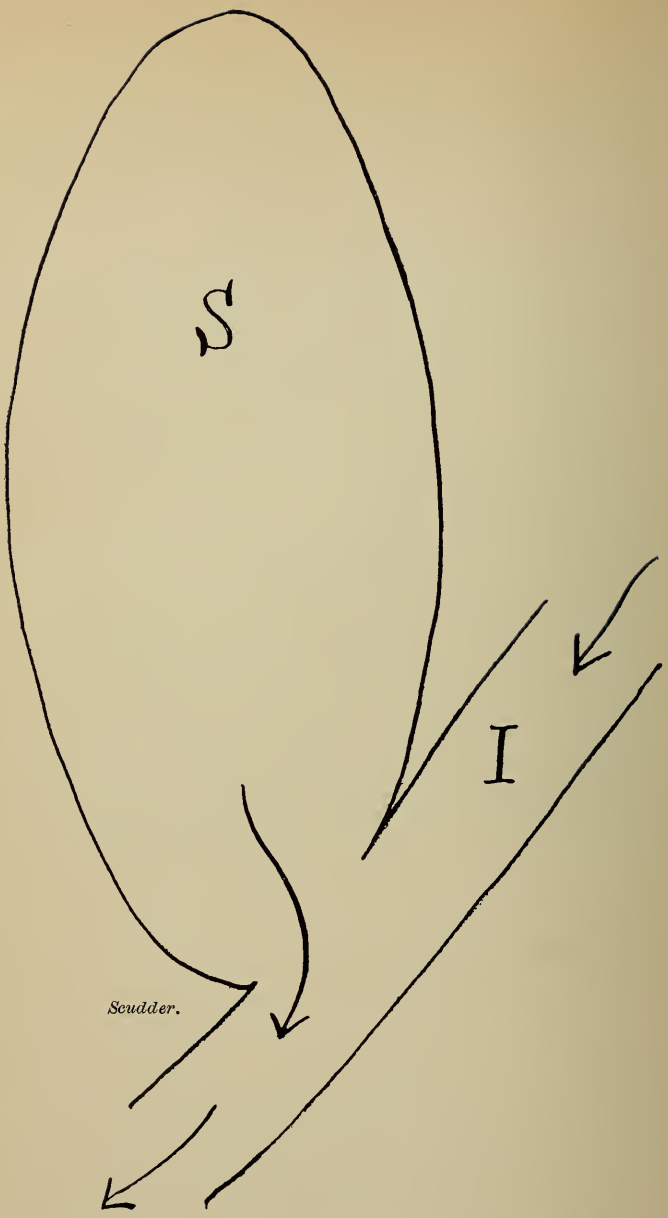

FIG. 10. — To show diagrammatically the location of the opening secured by this operation between the stomach above and anteriorly and the jejunum below and posteriorly. *S* indicates the stomach cavity. *I* indicates the intestinal lumen.

(After Scudder, *Annals of Surgery*.)

The number of operators who use the short loop method, both in Europe and America, is increasing, and their results are steadily satisfactory. As we have said, it is one of our two operations of choice when gastro-enterostomy must be done.

Another operation, known as the operation of Chaput (Fig. 11), is posterior gastro-enterostomy with the long

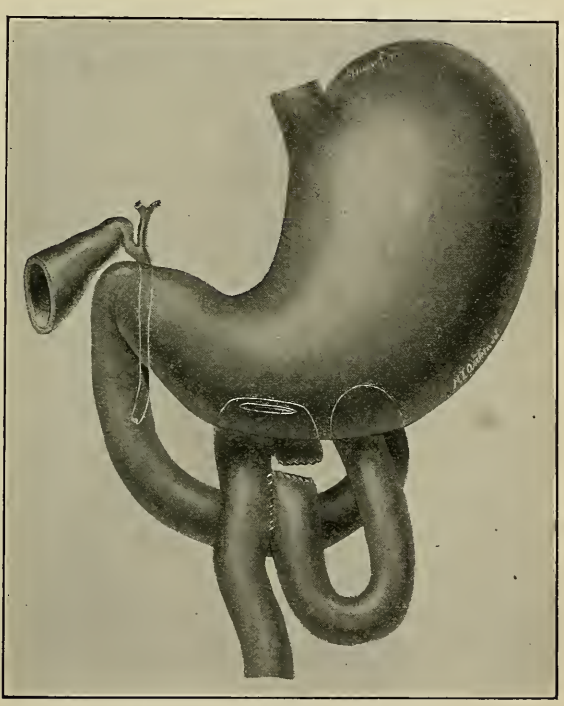

Fig. 11. — Operation of Chaput.

loop (fourteen to sixteen inches) plus entero-anastomosis, with section of the afferent loop between the anastomoses. Some surgeons take an even longer loop, — up to eighteen inches. The preliminary steps are similar to those already quoted. The loop in this case should be long enough to prevent any kinking at the ligament of Treit,

and to prevent spur formation at the anastomosis. We advocate an entero-enterostomy in these long loop cases, and unless there be some contra-indication, an occlusion of the afferent loop between the entero-anastomosis and the gastro-anastomosis. The resulting anatomical condition is, essentially, that produced by the so-called Roux operation, but the entero-enterostomy is a side-to-side instead of an end-to-side anastomosis.

The occlusion may be secured either by infolding the bowel longitudinally without opening it, "emplication," or by actually resecting the gut. We prefer the resection.

II. There is an extension of this operation of Chaput, —an extension which we regard as useful; we refer to closure of the pylorus by section. The resulting anatomical arrangement of the parts is so near to the normal that ultimate impairment of function seems impossible. The steps of the operation are (1) posterior gastro-jejunostomy with the long loop; (2) entero-enterostomy (and for this the button is safe and speedy); (3) section of the afferent loop between the two anastomoses; (4) section of the pylorus (Fig. 12).

There result from this a stomach with one drainage canal, that canal straight and uncomplicated; a duodenum opening into the drainage canal four to six inches below the stomach, and that duodenum now converted into a mere continuation of the common bile-duct.

This operation, in uncomplicated cases, is easy and rapid; subsequent stomach drainage is simple and direct; the new opening cannot close; vicious circle is impossible; and the resulting anatomical conditions

approach more nearly to the normal than is seen after any other form of gastro-enterostomy, hence any

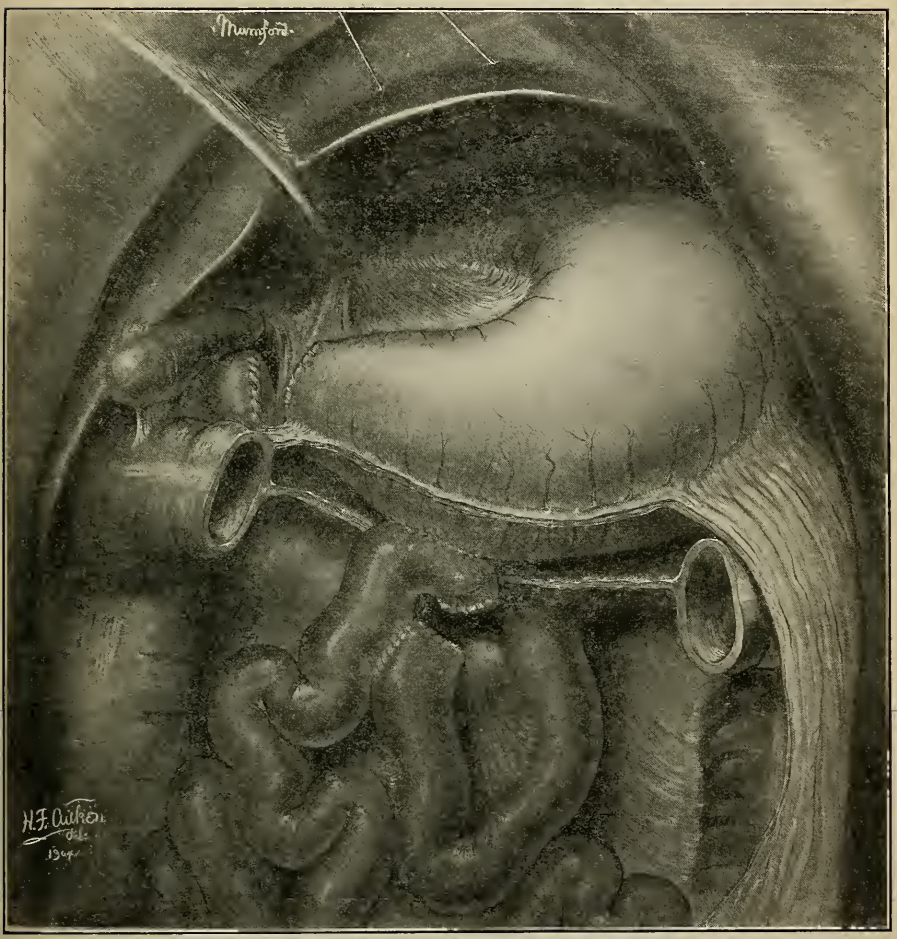

Fig. 12. — Operation of Chaput, plus section of the pylorus.

additional risk incurred by the two resections appears to be justified.[1]

[1] It goes without saying that this somewhat elaborate procedure should not be pushed to a conclusion in the presence of a failing pulse or threatening collapse of the patient.

The operation of anterior gastro-enterostomy, though in disfavor with many operators, is still practised by competent men. Bevan informs us that he habitually employs it, and has seen no reason to change his good opinion of it. It is performed, of course, as the name implies, by drawing the jejunum up over the omentum and attaching it to the lowest point available of the greater curvature of the stomach, — commonly in or near the pyloric region. Entero-enterostomy should always form an integral part of this operation.

The writers have had little experience with the anterior operation, for their knowledge of the experience of others turned them early to the posterior method. They feel strongly that either the first or third of the two posterior procedures already described is admirable.

III. Another operation for stomach drainage, and the *third* of those we advocate especially, is that known by Finney's name. Having seen it in Finney's hands, and had some little experience with it ourselves, we have come to feel that it is a method of the greatest value. It is physiologically correct, for the stomach is left with its one natural drainage outlet. There is no possibility of vicious circle or jejunal ulcer. It was said at first by Finney that the operation is applicable only when non-malignant stenosis without active ulcer is present. That assumption has been proved untrue by the author of the operation, though doubtless it is a fact that in the face of some of the complicated processes associated with ulcer, — adhesions, distortions, etc., — the mechanical difficulties of a "Finney" may be insurmountable.

In a word, Finney's method consists in the substituting of a large pylorus for a small one. It combines the advantages of Jaboulay's or Kocher's gastro-duodenostomy with the Heinecke-Mikulicz pyloroplasty. Properly, says Finney, the operation should be called "gastro-pyloro-duodenostomy." "Finney's pyloroplasty" is sufficiently accurate and descriptive. We give his own words: —

"Divide the adhesions binding the pylorus to the neighboring structures, also free as thoroughly as possible the pyloric end of the stomach and first portion of the duodenum. Upon the thoroughness with which the pylorus, lower end of the stomach, and upper end of the duodenum are freed, depends, in a large measure, the success of the operation, and the ease and rapidity of its performance. I wish to emphasize this as one of the most important points in the operation. Frequently, at first sight, the pylorus may seem hopelessly bound down, when after a little patient toil and judicious use of the scalpel and blunt dissector, it is found that it can be freed with comparative ease. A suture, to be used as a retractor, is taken in the upper wall of the pylorus, which is then retracted upward. A second suture is then inserted into the anterior wall of the stomach, and a third into the anterior wall of the duodenum, at equidistant points, say about twelve centimetres, from the suture just described in the pylorus. These second sutures mark the lower ends of the gastric and duodenal incisions, respectively. They should be placed as low as possible in order that the new pylorus may be amply large. Traction is then made upward on the pyloric suture, and downward

in the same plane, on the gastric and duodenal sutures. This keeps the stomach and duodenal walls taut, and

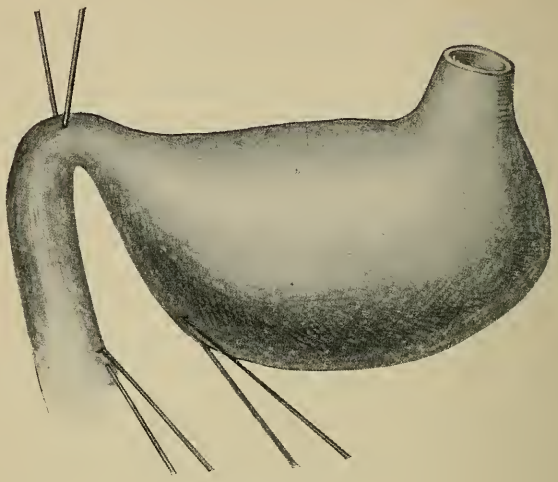

FIG. 13.
(After Finney.)

allows the placing of the sutures with greater facility than if the walls remained lax. [See Fig. 13.] The

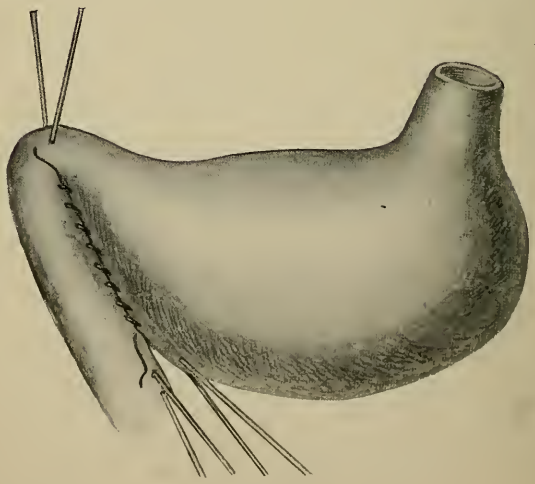

FIG. 14.
(After Finney.)

peritoneal surfaces of the duodenum and stomach, along its greater curvature, are then sutured together, as far posteriorly as possible. [See Fig. 14.] For this row I would recommend the use of the continuous suture, as it is more easily and quickly applied, and it can be reënforced after the stomach and duodenum have been incised. After the posterior line of sutures has been placed, an anterior row of mattress

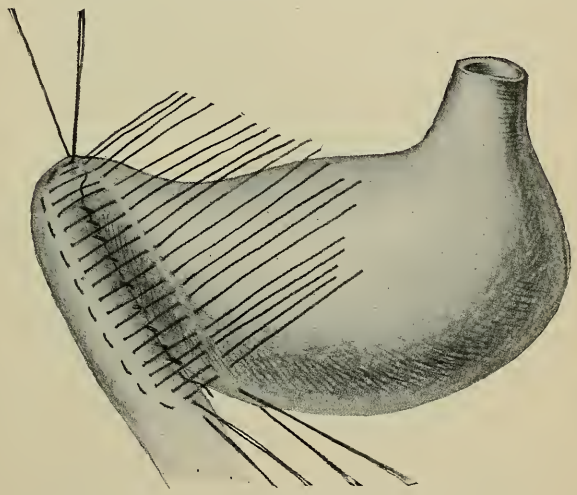

Fig. 15.

(After Finney.)

sutures is taken, which are not tied but left long in the manner indicated in Fig. 15. These sutures, after they have been placed, are retracted vertically in either direction, from the middle of the portion included in the row of sutures. [See Fig. 16.] Then, after all the stitches have been placed and retracted, the incision is made in the shape of a horseshoe. The sutures should be placed far enough apart to give ample room for the incision. The gastric arm of the incision is made

through the stomach wall just inside the lowest point of the line of sutures, and is carried up to and through the pylorus and around into the duodenum, down to the corresponding point on the duodenal side. Hemorrhage is then stopped. It is well to excise as much as possible of the scar tissue upon either side of the incision in order to limit, as far as possible, the subsequent contraction of the cicatrix. This procedure I

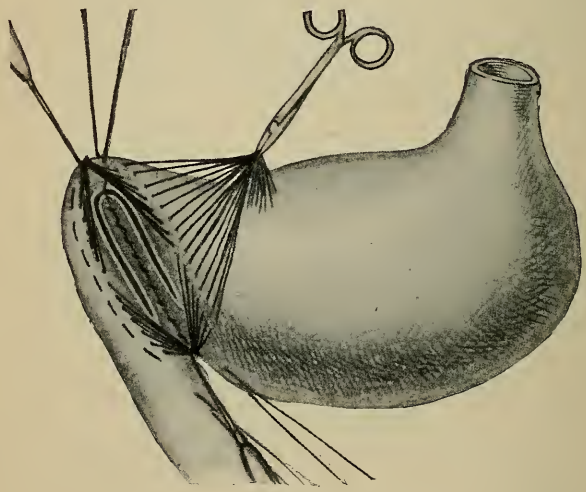

FIG. 16.
(After Finney.)

carried out in two of my cases with great satisfaction, and I should strongly recommend it in all cases where the walls of the pylorus are much thickened and there is much scar tissue present. It is well, too, to trim off with scissors redundant edges of mucous membrane, and prevent the reunion of the divided intestinal walls. The anterior sutures are then straightened out and tied [Fig. 17], and the operation is complete, unless one wishes to reënforce the mattress sutures with a few

Lembert stitches. [See Fig. 18.] This procedure, as is readily seen, gives the minimum of exposure of in-

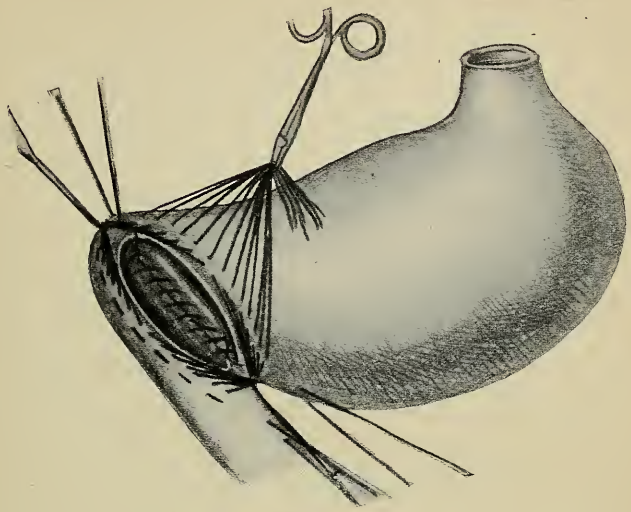

FIG. 17.
(After Finney.)

fected surface. All the stitches are placed and the posterior row tied before the bowel is opened, and it

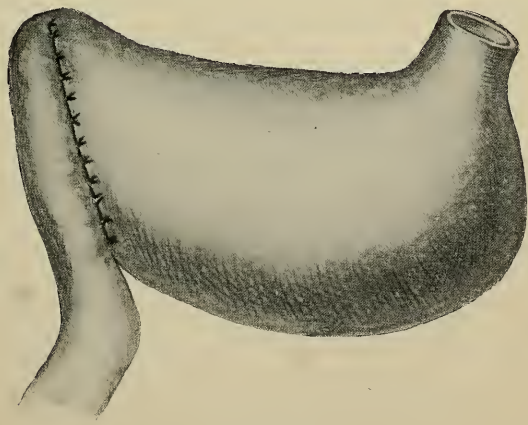

FIG. 18.
(After Finney.)

remains open just long enough to control the hemorrhage. The size of the newly formed pyloric opening is limited in this operation only by the mobility of the stomach and duodenum, and the judgment of the operator. In all of my cases the incision has been about twelve centimetres in length, and could have been made longer, had I chosen to make it so. Unless the stomach is very much dilated or has descended to an unusual extent, the lower limit of the new outlet is at or near the level of its most dependent portion.

"When the stomach is much dilated, there is no contra-indication in this operation to the performance, at the same time, of gastropexy or gastroplication, if one considers them indicated."

The old Heinecke-Mikulicz pyloroplasty has fallen into disfavor and is now rarely employed. It was well enough so far as it went, — that is, it restored the pylorus to a normal caliber ; but it afforded inadequate drainage for a dilated or dislocated stomach. Moreover, many cases of recontraction have been reported. Finney's operation overcomes these difficulties. The opening may be carried far down in a dilated stomach and the great opening secured cannot conceivably close unless it be again extensively involved in disease. The opening supplies admirable drainage and from the pyloric region too. One objection to it is involved in the question of partial gastrectomy as practised by Rodman. Rodman's theorem is founded on the multiplicity of ulcer and its probable change to cancer. Now ulcer and cancer are found mostly in the pyloric portion and in the duodenum. Therefore Rodman proposes to combine drainage operations with excision

of the cancer-bearing pyloric region. This is one of the questions of gastric surgery which is being debated. It is not improbable that we shall come to adopt in part Rodman's apparently radical views.

That form of gastro-enterostomy which has come to be known as the operation of Roux, though essentially the same at that of Wölfler, is interesting and important. The method of this well-known procedure is to cut in two the jejunum about sixteen inches from its beginning, and implant the distal or efferent end into the stomach. The proximal end (duodenal portion) is then implanted into the distal end about eight inches from the new stomach opening. The resulting formation has appropriately been called "en Y."

The various modifications of gastro-enterostomy have been devised to minimize the chances of vicious circle, one of the most serious complications that may follow gastro-enterostomy.

Now vicious circle[1] is a much abused and misunderstood term. For the establishment of a vicious circle a patent pylorus is essential; and by the term "vicious circle" we mean to indicate the current set up by the passage of stomach contents by the way of the pylorus into the duodenum, and then through the anastomosis back into the stomach. So the orbit of the vicious circle is always confined to the afferent loop and the stomach. "Reflux vomiting" is said to be due to the flow of bile and pancreatic secretion into the stomach. Whether such back flow does or does not cause vomiting, it would appear that true reflux vomiting has sometimes

[1] See important article on "Gastro-enterostomy" by Cannon and Blake, in *Annals of Surgery* for May, 1905.

occurred from retro-peristalsis of the jejunum, causing return of chyle to the stomach. Various reasons for the vicious circle have been advanced. They all come down to the question of some sort of mechanical obstruction to the easy on-flow of intestinal contents, or to an intestinal paralysis. If there are adhesions about the efferent loop, stomach contents more easily gravitate to the afferent loop. If there are obstructing spurs or kinks, a similar catastrophe results. In the same way, with an open pylorus, and a very long afferent loop crippled by adhesions, it is probable that food and secretions may accumulate in the duodenum and be returned to the stomach.

Even with the Wölfler-Roux technique, reflux vomiting may occur. Fowler has introduced the manœuvre of occluding the afferent loop by an encircling silver wire between an entero-anastomosis and the gastro-anastomosis. This is essentially the operation we have already described, — the operation of Chaput, which cuts off the bowel, while Fowler occludes simply.

This is no place for an extended discussion of technique. To one important conclusion we have come, however. No one method is applicable to all cases. The surgeon must be guided by his findings.

We wish also to point out this fact: when the short loop of Czerny, von Mikulicz, Moynihan, has been used, vicious circle vomiting has not occurred, so far as reports tell. Reflux vomiting from adhesions is possible with the short loop, but it must be very rare.[1]

Another matter of technique which has much agi-

[1] For a valuable discussion of the subject of vicious circle and various methods, we refer the reader to G. R. Fowler's important article, *Annals of Surgery*, Vol. XXXVI, p. 695, 1902.

tated the surgical world is the question of mechanical devices for anastomosis. Such devices have been numerous, but to-day we see two which are popular, — the Murphy button and the McGraw ligature. Harrington's segmented ring is also gaining favor. Many surgeons, and we are among the number, prefer to use no mechanical device, whenever possible. It is fair to assert, we believe, that, on the whole, stitching the viscera to each other is the safest procedure, for then the dangers of breaking down, leakage, narrowing, and retention of a foreign body are reduced to a minimum. On the other hand, when speed is a desideratum, the button has its advantages; while for the same reason the McGraw ligature has become popular with some operators. We must in fairness recognize the advantages of such appliances, though we cannot sympathize with the enthusiasm of those who *always* use them.

The reader will observe that we have described these operations for drainage as the essential operations for non-malignant stomach disease. This rule of drainage applies to bleeding ulcer as well as to other pathological conditions. Sometimes the surgeon may be tempted to explore the stomach and deal directly with a supposed bleeding vessel; but in the great majority of cases this is needless and increases the danger. Drainage alone suffices.

In the case of suspicious tumors or thickening of the gastric wall, however, exploration is advisable often. It not infrequently happens that even an exploration fails to distinguish malignant disease from an ulcer with a greatly thickened base. In such case, if in doubt as to the diagnosis, gastrectomy is our operation

of choice. We shall describe gastrectomy in the next chapter.

The complications to be dreaded and the causes of death after drainage operations are exhaustion, persistent vomiting, pneumonia, and a break-down of the anastomosis with peritonitis. The methods of meeting these complications rest on general surgical principles. A proper selection and a careful preliminary preparation of the patient are extremely important. Postoperative stimulation, nutrient enemata, early feeding, elevation of the shoulders, plenty of water by the mouth, rectum, or under the skin, will suggest themselves to the reader.

Persistent vomiting probably means the vicious circle, which may develop early or after weeks, in which latter case it is doubtless due to cicatrices or the partial closing of the anastomosis. In such cases an exploration is imperative, when one may find that the breaking up of adhesions, an entero-enterostomy, a pylorectomy, or even a secondary gastro-enterostomy are demanded to correct the condition.

Why the development of pneumonia follows gastro-enterostomy is not always apparent, but experience shows that that is a complication to be dreaded.

Finally, that desperate calamity, a break-down of the anastomosis, demands the most active intervention if the patient is to be saved. With increasing experience and improved technique this catastrophe is infrequently seen.

Peptic ulcer of the jejunum, at the seat of the anastomosis, is another possible danger, but so remote that it is not seriously to be dreaded. In proportion to the

total number of operations reported this accident is very rare.

Such, in brief outline, are the striking conditions of non-malignant stomach surgery as we see them to-day.

These diseases are frequently and properly subject to operative treatment. The universally applicable operation is some form of stomach drainage.

Experience leads us to believe that posterior gastro-enterostomy with (1) the short loop, (2) the long loop with entero-enterostomy and occlusion of the afferent limb plus obliteration of the pylorus, and (3) the method of Finney, are the three operations of choice.

CHAPTER VII

CANCER OF THE STOMACH

It is a simple solution of the difficulty to say that operation for cancer of the stomach is never justifiable.

Even four years ago many of us were ready to agree with Fitz that "Exploratory laparotomies, whether by advice of the physician, desire of the surgeon, or urgency of the patient, are only too frequent." Bevan, publishing in 1903, said, "The mortality [in gastric cancer] is still large, and the final results in gastro-enterostomy and pylorectomy and partial and complete gastrectomy are such as almost to warrant the statement that all operations for malignant disease of the stomach are but palliative and not curative in character." So, too, Moynihan, in 1903, in a long and critical review of the subject, quoting liberally from the figures of Krönlein and von Mikulicz, was forced to the conclusion that, at the best, operation offers but a sad alternative to a natural death, and that so radical a procedure as total gastrectomy is but rarely permissible;[1] while J. B. Murphy, in the same year, though arguing earnestly for early diagnosis by exploration, showed by a great array of figures that up to that time the operative record was pitiable.[2]

Are we, then, to conclude that the question of the treatment of stomach cancer must be one largely of the

[1] *British Medical Journal*, Dec. 5, 1903.
[2] *Annals of Surgery*, December, 1903.

individual temperament of the patient? Statistics are interesting, but in the last analysis, is not the victim asked in effect whether he will make the journey to Tyburn by the way of Maiden Lane or Piccadilly? It is true that some few patients have been cured by gastrectomy, but the number is discouragingly small. For the vast majority the question is whether to die in the normal way or to submit to the wretchedness of an abdominal section with a fair chance of living a few months longer than nature intended. I who write this was for several years a practitioner of general medicine. I saw many cases of gastric cancer from the beginning of their symptoms. Some were operated upon, some were not. I am forced to admit that in those days and in the long run the patients fared best who were left to die. More than almost any other class these cases should be approached from the humanitarian standpoint. Some victims will take almost any risk for the sake of prolonging life; others prefer to die rather than drag out a miserable existence. So let each man choose.

It is not quite fair to compare, as has been done, this field of surgery with that existing a few years ago in the case of breast cancer. Disease of the breast may be recognized early; it does not strike so deeply and immediately at an important vital centre; in the minds of the laity, it is not associated with such horror; as a rule it runs a far longer course, unaccompanied by such a variety of distressing symptoms; cures by operation are far more frequent and attended with less immediate risk to life, even when the disease is advanced; the management of the convalescence is less difficult, and in

the case of recurrence, the lesion, being on the surface in most cases, lends itself more readily to palliative treatment. Argue as we may, we cannot get round the fact that surgery of malignant stomach disease is one of the most difficult in our art, — calling for the nicest judgment, rare skill, and great experience, not lightly to be entered upon by the average operator. Nor must we expect that with time and the perfecting of our technique the conditions will become simpler. Any man of fair training may amputate a breast, may dissect the axilla, or may remove a chronically diseased appendix; but only those especially skilled will ever be able to open the abdomen and deal successfully with the complicated and dangerous conditions so frequently found associated with malignant disease of the stomach.

This is no new field of labor. It is more than twenty-five years since Pean, in 1879, attempted a pylorectomy, — unsuccessfully, — to be followed by Rydygier in 1880. Billroth improved the operation and saved his first patient in 1881. His two methods are still taught in the schools. Scattering operators followed, with indifferent success. As early as 1883 Connor of Cincinnati performed total gastrectomy, but his patient died. In 1897 Schlatter was successful with a total gastrectomy.

In 1883 and in 1885 Courvoisier and then von Hacker devised posterior gastro-enterostomy, though as early as 1881 Wölfler had made an anterior anastomosis; while it was not until 1894 that Jaboulay first performed gastro-duodenostomy.

So experience accumulated and technique improved

until to-day, when the list of surgeons includes Kocher, Roux, Maydl, Czerny, von Mikulicz, Krönlein, Wölfler, von Eiselsberg, Robson, Moynihan, the Mayos, Senn, Deaver, Murphy, Richardson, Bevan, Finney, and Wyllys Andrews as the most conspicuous modern exponents of this field of surgery.

Cancer of the stomach is a subject properly treated in this book. Gastric cancer is a digestive disorder. It is frequent; associated with certain prodromata it is common; it gives rise to marked symptoms; it is chronic in a sense; it is insidious; it is fatal. According to von Mikulicz and W. J. Mayo, one-third of all cancers are found in the stomach, and 2 per cent of all deaths are due to cancer of the stomach. We have been taught that it is a disease of sudden onset, coming on in persons of previously good health and strong digestion. Robson and Moynihan repeat the assertion. On the other hand, American operators have come to believe that cancer often develops at the end of a long dyspeptic career, and this is our own conviction, as we have already asserted. Von Mikulicz says 7 per cent follow old ulcer, while W. J. Mayo states that "A very large proportion of the cases which we have had gave an early history of ulcer of the stomach." Geography may have something to do with these divergent opinions, but we feel we can assert positively and on strong grounds that in America ulcer and other inflammatory processes are common forerunners of, if not actual etiological factors in, the production of gastric cancer.

We have made a personal study of some fifty cases of cancer of the stomach at the Massachusetts General Hospital, and in forty-one of the cases there was a

history either of ulcer or of long-continued digestive disturbance, of which the exact nature could not be ascertained. Since these facts have been borne in upon us we have questioned closely all persons in whom a diagnosis of gastric cancer could be made, and rarely have we failed to elicit a history of digestive derangements extending over several years.

Carcinoma of the stomach is primary in the great majority of cases, while of those gastric cancers which are secondary, most are merely extensions from a primary focus in the œsophagus. Having regard, then, only for those originating in the stomach, how are we to make the diagnosis?

In the first place, there is that factor of long-standing stomach disorder in persons over forty years of age. Von Mikulicz finds that men and women are about equally affected, and we know, of course, that cancer of the stomach occurs occasionally in young subjects. But take the patient over forty years of age with a history of stomach trouble, — heartburn, a sense of oppression, distress after food, increasing anorexia (especially distaste for meat), occasional nausea, perhaps vomiting, — all that should arouse our suspicion. Von Mikulicz believes that gastric cancer, like cancer elsewhere, may remain latent for a long time, though the average duration of life is but twelve months.

Such symptoms as we have given are suggestive merely; they do not admit of a positive diagnosis. Of course pain, vomiting, hemorrhage, tumor, are late and characteristic evidence.[1]

Will an analysis of the stomach contents help us in

[1] See Appendix.

the early stages? Unfortunately it will not, usually. Gastric motility may be diminished or it may be increased; hydrochloric acid may be absent, but more often it is present; the Oppler-Boas bacillus—a long non-motile organism, of the shape of a baseball bat—is present first or last probably in a majority of these cancer cases, but it is likely to be a late manifestation. The presence of lactic acid is evidence of some value, but its absence is of no significance. Traces of blood, discovered by the guaiac test properly performed, are extremely significant, however.

Can we then recognize or treat these early cases, in which we have such good reason to believe that a transformation from a benign to a malignant condition is in progress? Murphy, in a suggestive paper, in a vein of cautious optimism, has answered this question in the affirmative.[1] To the questions: "Do we recognize the transition?" he replies, "No"; "Can we?" he answers, "Yes." He asks: "How soon after the penetration of the basement membrane by these erratic epithelial cells are symptoms manifest, and what are the symptoms? Second, how soon after the penetration of the basement membrane by these erratic epithelial cells are the cells transmitted (*a*) through the lymph spaces to adjacent areas in stomach walls, (*b*) through lymphatic drains to neighboring lymph nodes, (*c*) through the lymphatics to the first filter gland, (*d*) from the primary filter gland to second and subsequent filter glands, (*e*) from the last filter gland to the chyle duct? How do they pass through the pulmonary capillaries? Where and how do they produce elective metas-

[1] *Annals of Surgery*, Vol. XXXVIII, p. 791, 1903.

tases?" These are searching questions, and the answer is not yet.

Another reason, if reason be needed, for believing that cancer develops on the site of benign precancerous lesions is that the location of the two is very similar, as shown by the following table, taken from Robson and Moynihan: —

Location	Ulcer	Cancer
Pylorus and lesser curvature	51.6%	70
Posterior surface	25	4
Cardia	7.9	9
Greater curvature	4.14	4
Anterior surface	8	3
Fundus	3.3	10

The only marked divergence in the two rows of figures appears to be in lesions of the posterior surface. Ulcer of the posterior surface is common, while cancer is rare on that site. The great majority both of cancers and ulcers, however, are found near the pylorus, in what we have come to recognize as the ulcer-bearing area.

The purpose of our argument is, through an examination of conditions, to ascertain, if possible, whether the pathological situation is hopeless or capable of amelioration, and to point out in what fashion, through surgery, that amelioration shall be sought. In the present state of our knowledge, with the exact nature of cancer in dispute, we can look for no cure through the measures of the internist.

From these and similar statistics we may conclude that cancer of the stomach is a primary disease of in-

sidious onset;[1] that it is usually located in the lower or pyloric region, and so is accessible to operative treatment, if taken early. Let us now consider briefly the probability of its spreading; especially let us consider the routes through which metastasis is most likely to occur.

Be it stated at the outset that in from 4 to 10 per cent of the cases no metastasis has been found, the enlarged glands present being shown to be merely hyperplastic. Therefore we may fairly say that in about one of twenty cases the chance of recurrence after gastrectomy is by so much decreased. Such glandular hyperplasia exists often in the case of ulcer also, and in the course of operation the glands should be sought and followed up, for thus we may light upon the site of the ulcer, as Lund has stated.

Cuneo and Most have demonstrated the lymphatic connections of the stomach. These connections may be divided into three distinct fields, which should be kept clearly in mind: —

1. The field of the fundus.
2. The superior gastric field.
3. The anterior gastric field.

Note at once this important fact: that the fundus is rarely the seat of carcinoma, and that its lymphatic glands are seldom involved. W. J. Mayo describes this condition as "the lymphatic isolation of the dome of the stomach." Owing to this local immunity, the fundus usually may be preserved in resections of the

[1] To quote W. J. Mayo, *Annals of Surgery*, March, 1904: —

"Graham, in one hundred and forty-five cases of cancer of the stomach, which came to operation at our hands, found a previous history of ulcer of the stomach in 60 per cent of the cases."

organ. Such few lymph channels as there are in this upper left-hand portion of the stomach drain toward the spleen.

The superior gastric field is the greater portion of the anterior and posterior walls of the stomach, including the pyloric region. Drainage here is toward the lesser curvature and the cardia as far upward and to the left as the gastric artery. In extirpation of most gastric cancers this is the important field for removal.

The anterior gastric field comprises the right half of the greater curvature and some small portion of the anterior and posterior walls. Thence the lymph stream is conducted into a few glands lying in the gastrocolic omentum and grouped mainly toward the pyloric end of the stomach. W. J. Mayo's cut (Fig. 19), adapted from Hartmann and Cuneo, illustrates admirably these arrangements. Note always the fact that most commonly the glands from cancer are found along the lesser curvature, those from ulcer along the greater curvature.

Finally, and in addition to these three groups of glands, there are those lying between the stomach and pancreas and along the cœliac axis and splenic artery. If these are diseased, their removal is almost impossible. Hence, as von Mikulicz remarks, "If these glands are clearly involved, a radical operation in most cases had better not be attempted."

The growths giving rise to malignant lymph nodes are roughly divided into *cylindrical carcinomata* and *spheroidal carcinomata.* The former include those variously designated "adeno-carcinoma," and "cylinder-epithelioma," or "destructive adenoma." The terms

"scirrhus" and "medullary" are used merely to indicate an excessive or scanty amount of fibrous tissue stroma. In both varieties degenerative and ulcerative processes are common, but the former or cylindrical variety is the better suited to surgical treatment.

Though cancer of the stomach is most common in the pyloric region, frequently obstructing or completely blocking that outlet, it rarely extends more than an inch into the duodenum, — a circumstance to be noted, — but it frequently involves other organs. That is a grave fact. Advanced gastric cancer is sure to spread by direct contact. The liver, the pancreas, gall-bladder, ducts, intestines, omentum, diaphragm, and even abdominal wall may be involved. There is no limit to the possibilities. Such extension and involvement may of course put radical operations out of the question except in those rare cases in which, the colon alone being secondarily attacked, a resection of that viscus may be done at the same time that gastrectomy is performed.

Such, in brief, being some of the conditions we have to face, let us now consider in more or less detail the technique of the two most important operations which concern us in this connection; and afterward let us attempt to estimate in how far such operations may be justified.

Gastro-enterostomy and pylorectomy, or gastrectomy, are the operations we must study. Of gastro-enterostomy, which is a palliative procedure consisting of making an anastomosis between greater curvature and jejunum, little need be said. Its purpose is merely to anticipate starvation due to an obstructed pylorus. It

side-tracks cancer of the pylorus and does nothing else. It is never indicated except there be obstruction, — never in disease of the fundus or cardia. In passing, let us observe that in the case of threatening starvation from œsophageal obstruction or cancer of the fundus, some form of gastrostomy, — Witzel's or Kader's method if you choose, — or a jejunostomy, may be indicated, at the discretion of the surgeon.

Sometimes one may do a posterior gastro-enterostomy for pyloric obstruction, sometimes and more commonly, an anterior operation, owing to the presence of difficult complicating posterior adhesions. A favorite and satisfactory method is by the Murphy button, as speed is generally essential. The McGraw ligature is popular with many surgeons when operating under these conditions.

Gastrectomy, however, is the operation which interests us especially, — partial gastrectomy or sometimes a mere pylorectomy; and various methods of performing gastrectomy have been devised. Billroth's first method consisted of cutting out the pyloric tumor, leaving a narrow duodenal margin, but taking off a considerable portion of the stomach. The stomach wound was then closed except for a narrow opening at the lower portion, into which opening the cut end of the duodenum was inserted. Naturally there was a suture angle left where the two organs were united, and at this angle leakage sometimes occurred. They came to call this "the fatal suture angle."

Billroth's second method consists in closing the cut ends of both stomach and duodenum and doing a gastro-jejunostomy, — obviously a safer and better pro-

cedure. Kocher makes an anastomosis between the posterior wall of the stomach and the duodenum, after closing his original stomach wound. Both of these operations are sound and valuable. With certain modifications employed by individual operators, they are

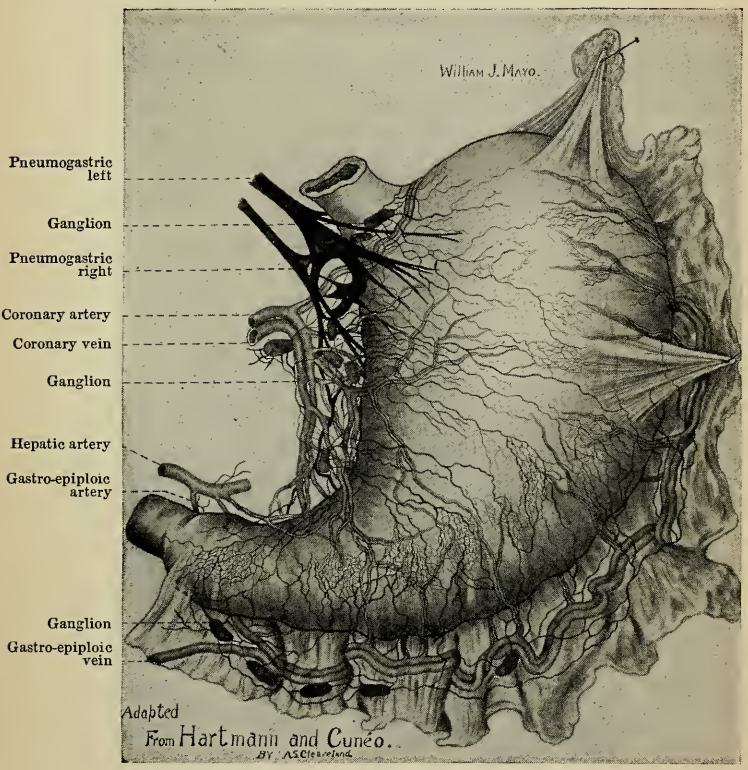

FIG. 19. — Showing anatomy of the stomach with especial reference to distribution of the lymphatics.
(After W. J. Mayo, *Annals of Surgery*.)

now in common use, — Billroth's second operation being perhaps the more popular, as the frequent immobility of the duodenum renders Kocher's gastro-duodenostomy sometimes difficult or impossible.

In our opinion the gastrectomy described by W. J.

Mayo, and founded on Billroth's second method, is most satisfactory and always applicable when any gastrectomy is permissible.

Somewhat paraphrased and abbreviated, his description is as follows: [1] —

In all cases the operation of gastrectomy may be outlined for convenience in six paragraphs. This Mayo does thus: —

A. Incision and exposure.

B. Control of hemorrhage.

C. Excision of the stomach with tumor.

D. Reëstablishment of the gastro-intestinal canal.

E. Avoidance of infection.

F. Prevention of shock.

A. In the first place, explore to see whether or not operation shall be done, and what operation. A short median incision about the middle of the epigastrium answers well. If necessary, it may later be extended in either direction. After exploring, if it seems best to abandon any further operation, sew up as quickly as possible and get the patient back to bed. In most of the cases the writers have been satisfied with the rapidly inserted, through-and-through silkworm-gut or wire sutures. They are removed in a week and, with the wound reënforced by straps, the patient is gotten out of bed. Mayo, with excellent reason, prefers to sew with buried wire or silk. Either method has seemed satisfactory to us, the principle being the same in both.

If, now, we have decided to proceed with the operation, the incision is rapidly enlarged as much as seems best.

[1] *Annals of Surgery*, March, 1904.

The writers prefer a long incision — ensiform to navel, if necessary — and have seen no hernia come from it. The next and immediate procedure is to tie off the gastro-

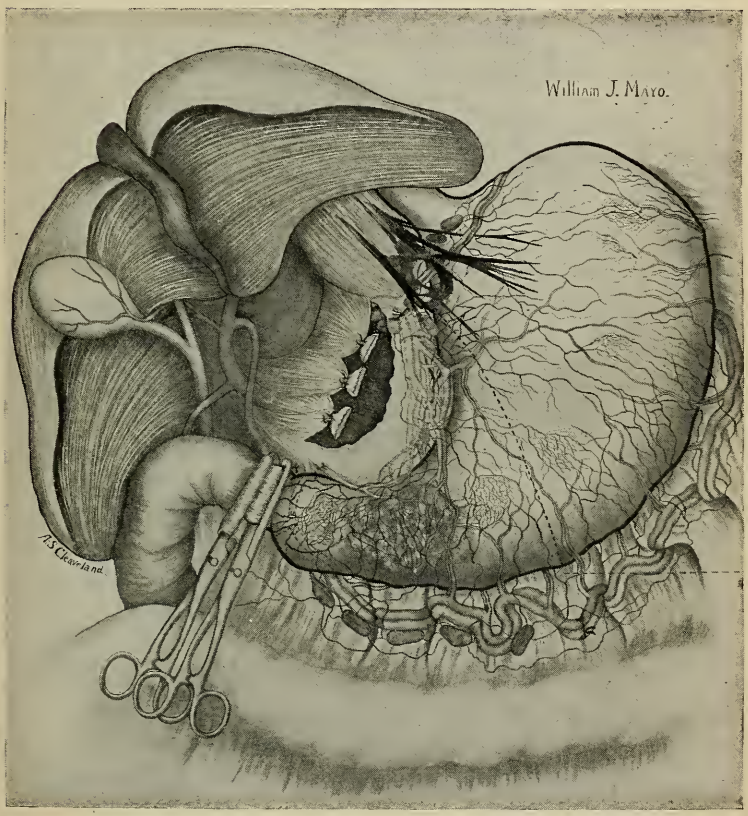

Fig. 20. — Showing ligation of gastrohepatic omentum and superior vessels in such manner as to leave all the lymph nodes attached to the part of the stomach to be excised; also lines of division of duodenum and stomach.
(After W. J. Mayo, *Annals of Surgery*.)

hepatic omentum close to the liver, thus opening widely the lesser cavity of the omentum and mobilizing the pyloric end of the stomach (Fig. 20); for be it remembered always that in this discussion we are considering

cancer of the pyloric end. The entire area exposed is packed off with gauze.

B. The control of hemorrhage in these extensive stomach operations is an extremely important matter; but as Mayo remarks, when the principle of ligaturing four important arteries is intelligently grasped, the procedure is no more difficult than is that of securing the vessels in an abdominal hysterectomy. There are two arteries to be tied above the stomach — the gastric and the superior pyloric; and two arteries below — the right and left gastro-epiploics. The gastric artery is best secured at once by a double ligature, where it joins the lesser curvature, about an inch below the cardia. The superior pyloric, a branch of the hepatic, is easily found and tied just above the pylorus. Then to get at the two lower vessels a hand is passed into the lesser cavity behind the pylorus, the gastrocolic omentum is found and elevated from the transverse mesocolon, and the right gastro-epiploic artery is thus isolated and secured from the front. Then the left gastro-epiploic artery is tied at a suitable point and the intervening gastrocolic omentum is secured and cut away. Mayo points out that in performing these last manœuvres great care should be used not to interfere with the middle colic artery which runs beneath in the transverse mesocolon and supplies the transverse colon.

C. The removal of a portion of the stomach is now a comparatively simple matter (Fig. 21): Double clamp the duodenum and divide it with the cautery between the clamps. The stump of the duodenum is left protruding about a quarter of an inch from the lower clamp and a continuous catgut stitch is run in, uniting through

all layers the edges before the clamp is removed. Then the stump of the duodenum is turned in with a purse-string silk suture, and so left. The second portion of

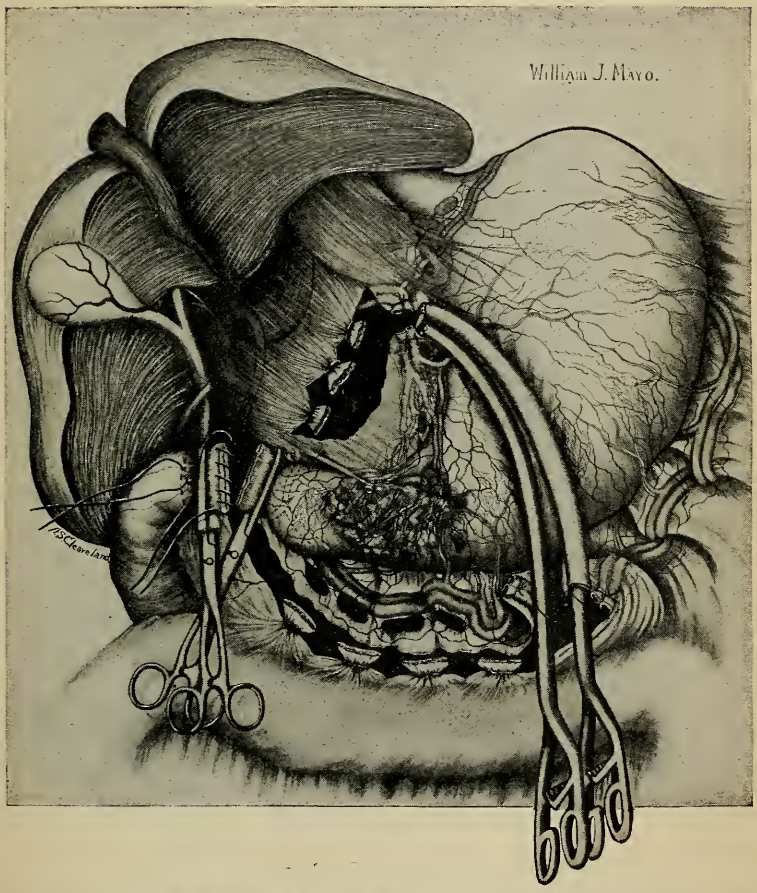

FIG. 21. — Showing methods of excision. Note that all the glands on the greater curvature are removed in every case.
(After W. J. Mayo, *Annals of Surgery*.)

the excision through the body of the stomach itself is accomplished in much the same fashion, though on a larger scale. The viscus is first securely grasped by one of the rubber-guarded holding clamps, on which

Kocher lays such stress, while just below it, at an interval of half an inch, is placed from below upward a strong biting clamp to prevent leakage. These clamps, when in place, run from Mickulicz's point of election

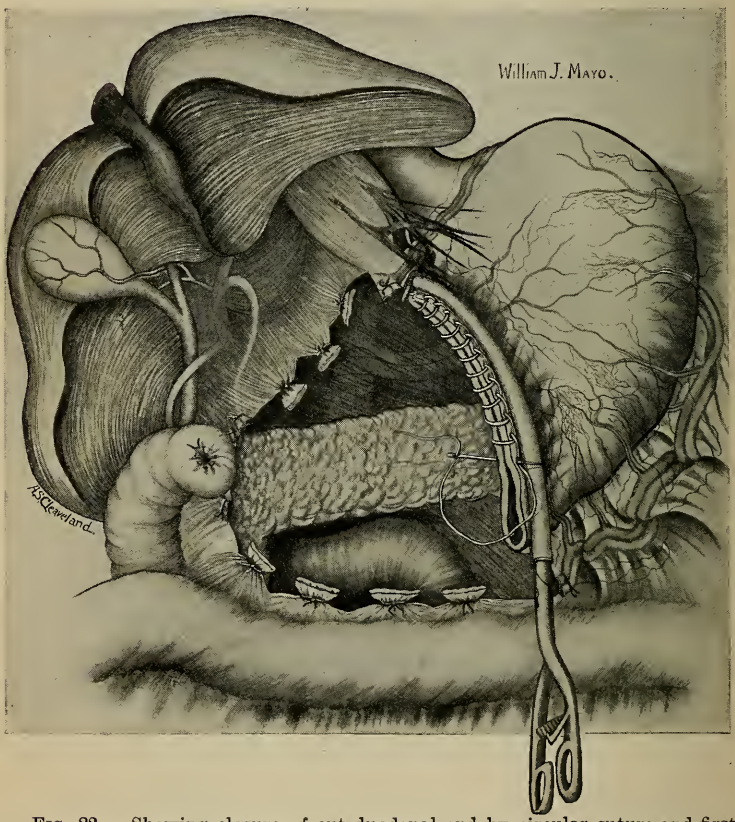

Fig. 22. — Showing closure of cut duodenal end by circular suture and first row of sutures being placed on the stomach side.
(After W. J. Mayo, *Annals of Surgery*.)

above — that is, from the severed gastric artery — to Hartmann's point of election below. Then cut off with the cautery the stomach between the two clamps and so remove the tumor. The severed edges of the stomach stump are caught together with a catgut button-

hole stitch and the line of suture is then turned in with Lembert stitches applied preferably on the right-angled plan recommended by Cushing (Fig. 22). Our admirable cuts borrowed from W. J. Mayo illustrate these

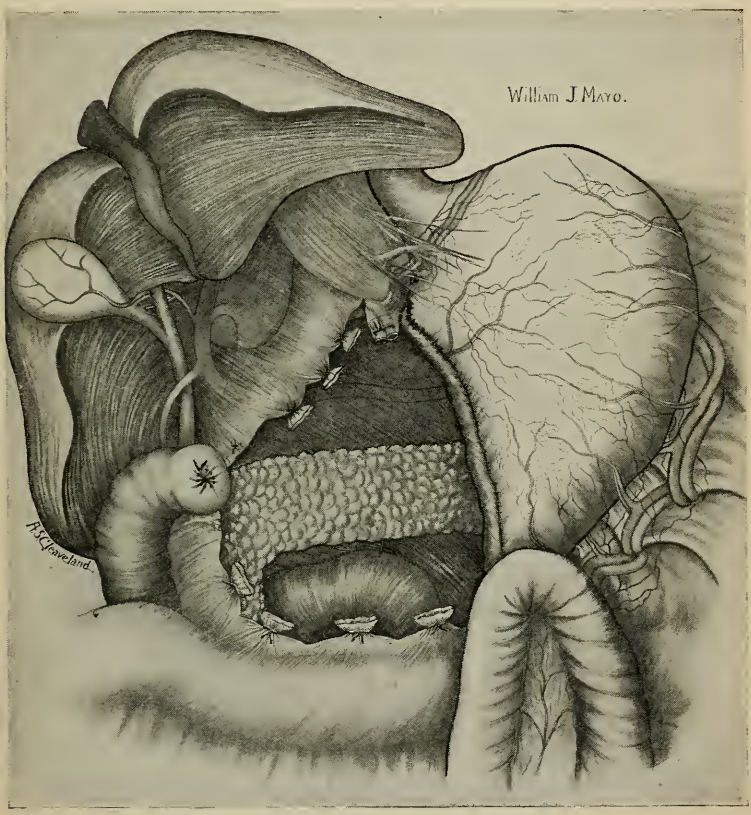

Fig. 23. — Showing completed operation.
(After W. J. Mayo, *Annals of Surgery*.)

steps. Sundry modifications of the procedure have been suggested or may recommend themselves to the individual operator, but the general plan outlined here is satisfactory.

D. It now remains to restore the gastro-intestinal

canal. Kocher's method of inserting the severed duodenum into the posterior wall of the abbreviated stomach has been described, but it is preferable to make a gastro-jejunal anastomosis (Fig. 23). It is usually easier and always satisfactory. Healthy tissues are being dealt with and there is no risk of tension. A sound and speedy healing with good functional results is to be expected.

E. There are two forms of infection which must be guarded against; direct cancer infection from the growth removed, and the ordinary pyogenic infection. Cancer infection occurs. It may be developed in the wounded viscera; it has been seen in the needle punctures of the abdominal wall even. In view of such possibilities Mayo recommends the Paquelin cautery for cutting through the duodenum and stomach. From our previous description it is seen that the greatest care is taken to guard against micro-organisms from the gastro-intestinal tract. The clamps, the careful gauze packing, the cautery, — all are important. Then, too, painstaking sponging of the whole field with wet compresses is recommended, and drainage when there has been obvious soiling, — the use of a "cigarette drain," leading it out from behind the pocket above the transverse colon, taking pains not to bring it in contact with the crippled viscera; it should emerge at the lower angle of the abdominal incision.

Most important of all, however, for the avoidance of infection are those measures which we must use to anticipate and subdue

F. Shock. — Although it is true that in simple uncomplicated cases there is little or no shock, we must always

face these operations seriously. A patient is never truly sound who carries in his stomach ever so trifling a malignant growth. Such a patient usually has other conditions with which to contend, as Turck has pointed out.[1] There is likely to be a more or less profound cardio-vascular disturbance, anæmia, gastro-intestinal atony with resulting toxemia. To quote: "The latent cholemia or uremia, the general insufficiency of normal metabolism or cellular inactivity, — these are the pathological conditions with which the surgeon is confronted."

Bearing continually in mind, therefore, the probability of such complicating dangers, we must take our measures. It is impossible absolutely to disinfect these stomachs, but we may approximate to asepsis, and for two or three weeks, if possible, before operation we must turn our attention to local stomach cleansing and the building up, by proper foods, stimulants, and tonics, of the patient's general condition. Accustom him to the use of the stomach tube. Wash the stomach daily. Feed with an easily digested nitrogenous diet. If necessary, supplement this with nutrient enemata. Get water into the system. If the stomach fails to take care of water, give hypodermic or rectal infusions of salt solution, thirty ounces every twelve hours, for at least two days before the operation. Have the patient well stimulated with nux vomica or strychnine.

At the time of the operation one should give a hypodermic of morphine and atrophine before the anæsthetic and use a minimum amount of the anæsthetic, — preferably ether, — and see to it that the anæsthetist is a man

[1] Fenton B. Turck, in *Chicago Medical Recorder*, June, 1903.

of experience. Shock is sometimes sudden and profound during these operations. We have seen a patient die on the table under the hands of an inexperienced but over-confident anæsthetist.

It is well to use strychnine if it is indicated during the operation, and a stimulating enema of six ounces of black coffee when the patient is put to bed.

As for the after-treatment, — that is very simple. The patient's head and shoulders are raised on four or five pillows to take visceral pressure from the wounded organs, and so to promote healing. For two days rectal feeding is employed, though water by the mouth is given after twelve hours. On the third day regular liquid feeding by the mouth is begun cautiously, and is rapidly worked up until, at the end of ten days or even less, a fairly full diet may be allowed. The patient is out of bed in two weeks, and is encouraged to resume a more or less active life within the month. So much for the conduct of the operation itself.

Let us now consider briefly what *end*-results we may look for from such proceedings. In the first place, we present a few statistics of *immediate* results, — a partial list, but giving figures and illustrating what surgery has done during the past five years. It will be seen that there has been a fairly constant improvement. The dates are the dates of publication, though it is impossible to tell how far back into pioneer days some of the writers began the collection of their cases.

GASTRECTOMIES

IMMEDIATE RESULTS

		CASES	DEATHS	MORTALITY PER CENT
1900	Robson	572	174	30.4
1900	Hartmann . . .	20	5	25
1901	Carle and Fantino . .	—	—	20
1901	Rydygier . . .	25	17	66
1901	Morison	16	7	45
1902	Krönlein . . .	50	14	28
1902	Mayos	28	6	21.4
1903	Murphy	14	4	28.6
1903	Kocher	24	4	16.6
1903	Krause	14	4	28.6
1904	Mayos	13	1	7.7
1904	v. Mikulicz . . .	56	26	46.5

Certainly that is a table interesting and suggestive. It indicates, if it indicates anything, that, with the exception of von Mikulicz, in the hands of the best surgeons the immediate mortality from partial gastrectomy has fallen in five years from something in the neighborhood of 50 per cent to less than 30 per cent. In other words, with properly selected cases, the operation is not much more dangerous than an attack of pneumonia; indeed, W. J. Mayo writes us that "gastrectomy for cancer can be done with small mortality, and looked at even from the standpoint of relief is much better than gastro-enterostomy; with a promise at least of cure, — so that we give the benefit of the doubt to gastrectomy."

One hears the results of gastrectomy continually compared with the results of gastro-enterostomy. That is not a fair comparison. Gastrectomy is undoubtedly a more dangerous operation than is gastro-enterostomy,

other things being equal. But other things are not equal. One operation removes a malignant disease and a foul focus. The other operation is for drainage, but the foul focus is left. One is done, as a rule, in the early stages of the disease; the other, in cases of advanced disease. Moreover, the mortality record of a given operator in cases of gastro-enterostomy will be dependent largely on the chances he takes. Munro's figures in the subjoined table are an example. It appears from a study of his cases that he pursued his operations to the end often in the face of desperate conditions. All of his cases were late ones. Often he would have done nothing more than explore had he not been enjoined by the patient to complete the operation at all risks. Little is gained by a comparison of figures, but we give here a few from the reports of the last five years.

GASTRO-ENTEROSTOMY FOR CANCER

		Cases	Deaths	Mortality Per Cent
1900	Hartmann	40	8	20
1901	Robson	23	10	43.5
1901	Carle and Fantino . . .	24	9	37.5
1902	Krönlein	74	—	24.3
1902	Körte and Herzfeld . . .	30	7	23.3
1902	Mayos	107	10	9
1903	Krause	29	14	48
1903	Murphy	18	3	16.6
1904	Munro	21	12	57.1
1904	Robson	29	3	10

Such being the figures, and death in a short time being inevitable, what is to be concluded as to the value

of this palliative operation? From the statements of various reporters one sees that about half the patients die within a month, practically soon after the operation. A rare case may survive for two years, the average of the small remainder live less than six months. According to their views of euthanasia, the opinions of surgeons vary. Says Munro,[1] "It is almost impossible that the discomfort from a rapid anastomosis can begin to approach the suffering from starvation and vomiting; on the contrary, the relief that so quickly follows, sometimes within twenty-four hours, is one of the most gratifying experiences that the surgeon as well as the patient can enjoy."

Quite another estimate is that of von Mikulicz, who says:[2] "The condition of the patient after gastro-enterostomy is often such that one cannot speak either of temporary cure or marked improvement. In view of the considerable number of patients who die within a few days after operation, and the still greater number who live only a few weeks, one must conclude that gastro-enterostomy for cancer of the stomach is an operation of little value and one which is likely to be performed less and less often."

Probably both are correct. It depends upon the side from which one approaches the shield. Combine the action of a wise and experienced surgeon with the expressed wishes of a thoroughly enlightened patient, and the surgeon will probably act correctly in any given case.

That question of the wisdom of partial gastrectomy

[1] *Boston Medical and Surgical Journal*, August 11, 1904.

[2] Von Bergmann's "Surgery," Vol. IV, p. 385.

and of the value of the end-results obtained is beginning to assume a new aspect, — possibly a more hopeful aspect. With careful selection, a goodly number of patients survive the operation. Let us inquire now, from the scanty sources accessible, what may be the hope of such patients for relief, for comfort, for prolonged life, and even for permanent recovery.

These are Krönlein's figures: out of fifty excisions, fourteen died at once, leaving thirty-six to trace. Of those thirty-six "recoveries," twenty-three had recurrence within the year, and died. *Thirteen* were living at the time of the report; what their comfort may be is not known.

These are von Mikulicz's figures: of one hundred excisions, thirty-seven died at once, leaving sixty-three to trace, — and fifty-eight were traced. Of these, thirty-eight had recurrences and died. *Twenty* were living at the time of the report.

In other words, from those two clinics we learn that 22 per cent lived from one to eight years. And von Mikulicz states of his that seventeen survived a year or more, ten more than two years, and four more than three and one-half years. Of those last four, none shows any sign of recurrence, so that they may be regarded as cured. Moreover, von Mikulicz tells us that of those who survived the operation, the average duration of life was more than sixteen months.

In more fragmentary fashion here are a few statements from other surgeons, — most of them rather ancient statements. In 1898 Krönlein had had twenty-four cases with nineteen recoveries. Two were alive in their fourth year, while the average

duration of life for those who died had been sixteen months.

In 1899 Maydl reported that the average duration of life for those who survived the operation was 11.7 months.

In 1898 Kocher published his interesting list of fifty-seven cases with fifty-two immediate recoveries and eight "cures," — alive between two and ten years after the operation.

In 1899 Czerny reported twenty-nine cases with eighteen recoveries, and of the eighteen the average subsequent duration of life was twenty-two months.

Such are some of the figures from two to seven years old. Other men have encouraging statements to make, but at this writing there are few final reports.

In August, 1904, W. J. Mayo stated to us that he and his brother had "six or seven cases more than two years; one, three years; and one, three years and seven months before death."

Moynihan (in an exhaustive article in the *Practitioner*, December, 1903) gives some interesting figures gleaned from von Mikulicz's and Krönlein's reports on the subject of gastric carcinoma: —

	Krönlein	v. Mikulicz
Cases not operated upon, lived from first symptoms	12.5 mo.	11.5 mo.
Explored cases, lived an average of . . .	13.0 mo.	14.3 mo.
Gastro-enterostomies, lived an average of . .	15.5 mo.	14.0 mo.
Gastrectomies, lived an average of . . .	26.5 mo.	24.5 mo.

That is a fair summary of the situation, and the question returns again, What are we to do with this disease? One may repeat the platitude that the diagnosis must be made earlier, in order to render operations effective,

On the contrary, operations must be done to make the diagnosis. There seems no alternative to this dilemma at present. Middle age, with or without a long history of gastric disturbance, anorexia, distaste for meat, a craving for highly seasoned food, progressive emaciation, and debility, — these symptoms should make one very suspicious. Loss of gastric motility, vomiting, gnawing discomfort amounting to pain, — these come near being positive indications, even though no tumor be felt. As to that question of the presence of a tumor there has been much misconception. It has been said, and is still asserted, that the mere presence of a palpable tumor means disease so advanced as to contraindicate excision. From that statement we dissent. A small, hard tumor of the pylorus may be felt early, and if it is movable we should hope to perform a successful gastrectomy; whereas an extensive tumor of the posterior pyloric region of the stomach may run its course without being obvious to the examining hand.

Special consideration of complete gastrectomy has been purposely omitted in this chapter. That is an operation which is justifiable under the most unusual circumstances only. Thirteen cases have been reported at length, of which four died immediately. The rest lived from one to two years, and one possibly longer. We cannot learn that their lives were comfortable, and we do not feel that this operation ever will be regarded as more than a last desperate measure.[1]

[1] Complete Removal of the Stomach (belated note).

The following is taken from a review of Böckel's book, "De l'Ablation de l'Estomac, 1903." At the date of publication the number of cases reported was 48, and of these the result was unknown in 2. Of

Aside from the question of complete gastrectomy, however, we believe that cancer of the stomach, or suspected cancer of the stomach, should receive the surgeon's consideration. As with appendicitis, disease of the bile passages, gastric ulcer, and other conditions which are now universally regarded as proper subjects for surgery, gastric cancer should have the benefit of a prompt surgical consultation. If a disease is ever a subject for operation, who is to determine when the exact moment has arrived? The wise and experienced internist calls a surgeon the moment he suspects appendicitis,—not necessarily for operation. The wise internist and the wise surgeon both appreciate that they must work constantly together. In the old days when the general practitioner was internist and surgeon in one, he might postpone such consultations indefinitely. To-day these two functions no longer rest with the same individual.

If it is true that the experienced surgeon and the wise internist have their limitations and are interdependent, how much more true is it of the distant, overworked general practitioner and the surgeon! Cancer is common, one-third of all cancers are in the stomach, *early* exploration has a vanishing mortality, and in *early* excision lies the only hope of cure.

the remaining 46, 18 died and 28 recovered, giving a mortality of 39.1 per cent. In 9 cases collapse was the cause of death, in 7 purulent peritonitis, and in one pneumonia. Seven of the 28 patients who have recovered are not available for a final report. Of the remaining 21, 11 have died of recurrence after an interval varying between five months and five years; one died of intestinal obstruction without recurrence seven and a half months after the operation, and another in two years, of phthisis. Eight of the patients still enjoy the best of health. In the duodenum near the gastro-intestinal anastomosis a pouch forms which gradually dilates, and to a certain extent acts as a new stomach. Digestion goes on without disturbance, and there is a gain in weight.

CHAPTER VIII

THE BILE PASSAGES

In a consideration of disease of the bile passages, there are two questions which present themselves at once: —

(*a*) *Shall we operate?* and

(*b*) *How shall we operate?*

To the first of these questions let us turn ourselves in this chapter, and to reach a conclusion in the matter let us take up some of the text-book details and make a study of conditions.

At the outset we insist that much of the prevailing phraseology is misleading. Writers continually talk about *disease of the gall-bladder* and *gall-stone disease*, — phrases well enough so far as they go, but they do not tell the whole story. Even Mayo Robson, in the various editions of his well-known book, uses the title, "Gall-bladder and Bile-ducts." The classical word "cholelithiasis" is equally misleading. We are discussing *disease of the bile passages*, of a system of passages. The gall-bladder is but a *part* of the system; cholelithiasis is but *one manifestation*, though an important one, of the disease. We have to deal with infection, inflammation, stone formation, suppuration, ulceration, cicatrization, stenosis, perforation, fistula formation, adhesions, peritonitis, local or general, malignant changes, and the involvement of other organs.

In viewing carefully this complex process, one sees that the confusing and involved, many-titled investigation quickly resolves itself into the study of one broad, progressive, and far-reaching problem.

The first and most important fact in connection with disease of the bile passages for the practitioner to appreciate is that the underlying cause is an infection: and the method of that infection is worth considering, — although, indeed, writers are not as yet altogether in accord as to what that method may be. Certain facts, however, are to be regarded as fairly well established: that the organism concerned is commonly the colon bacillus, though the bacillus typhosus is not infrequently the offender; and that the mode of entrance is either through the blood current or through the ducts, working upward from the intestine. The probability is that infection from the intestine is far the more common method. C. A. Ewald, in a paper read before the Congress of American Physicians and Surgeons, at Washington, in May, 1903, said: "It is an established fact that our ideas concerning this disease have made marked fundamental changes during the last ten or fifteen years. We now know that this condition is due to a bacterial infection and not to the presence of gall-stones, the origin of which has always been more or less hypothetic."

There seems to be no doubt that, in addition to an invasion of organisms, stagnation of bile is essential to gall-stone formation, and it is obvious that bacterial invasion, associated with swelling of the mucosa in the ducts, results in stagnation and a consequent precipitation of cholesterin from the involved epithelial cells.

Stones are formed from such a precipitate. These stones in their turn frequently act as an irritant to the mucosa lining the passages; the irritated mucosa furnishes a suitable lodgement for pathogenic organisms; further swelling, desquamation, and precipitation of cholesterin follow, and so we have established a vicious circle. For many years it was assumed that fresh bile in healthy subjects acts as an antiseptic. Recent observations do not confirm this view. Fresh bile at the best is sterile, and some observers have found that it may act as a culture medium. Indeed, Ewald says that in the lower portion of the common duct the bacillus coli communis is commonly found, but that ordinarily it is harmless there.

It is agreed now that gall-stones arise from a catarrhal condition of the mucosa, associated with a swelling and desquamation of that membrane, and it is the fact of that catarrh, due to infection, upon which we must constantly fix our attention.

That catarrh in itself is not always a trifling condition. It may cause severe symptoms, and it may go on to severer forms of inflammation without necessitating the formation of any stones, though it is fair to assume, from such knowledge as we have, that stone formation commonly is associated with the inflammatory process.

In the lay mind, — indeed, in the minds of many physicians, — actual stones are the *sine qua non* of trouble in the bile passages; and that impression has been the source of countless errors. We recall a case in which the diagnosis of "gall-stones" was made, on the strength of frequent long-continued attacks of boring pain in the right hypochondrium. Finally an operation was con-

sented to by the patient, when nothing was found but a thin-walled gall-bladder, containing bile-stained infected mucus, draining ineffectually through a partially obstructed cystic duct. The patient and her family were chagrined that no stones were found, and were sceptical about possible benefit from the operation. However, the cholecystostomy which was done, followed by three weeks of drainage, relieved the congestion, freed the ducts, and resulted in a permanent cure.

These infections of the bile passages do not commonly make any *permanent* impression on the hepatic and common ducts, for those structures are main channels and are subject to fairly constant natural drainage; but when the inflammation spreads to the cystic duct and gall-bladder it finds conditions there very different anatomically,—conditions which seem designed to favor especially chronic inflammation and stasis, and stone formation.

It is not the *acute* forms of infection that result finally in stone formation. The acute forms are ugly things; they go on rapidly to suppuration, ulceration, and gangrene even. It is the chronic, indolent catarrh that we look to as the important factor in the etiology of calculi.

There is another term whose definition must be agreed upon in discussing these processes,—"cholangitis." The books are not in agreement. According to some, cholangitis is an acute infection of the bile passages within the liver, rare and fatal. According to others, it is an infrequent suppurative inflammation of the common duct and radicles of the hepatic duct. Such conceptions are rather ancient and do not appear, to us, to express modern knowledge of infections of this region.

We regard cholangitis as a not infrequent disease, and we see no reason for limiting the term to inflammation of a portion of the bile passages, nor do we regard it as indicating any particular degree of activity in the infection. Cholangitis is an inflammation of the bile passages, — localized or general, mild or virulent, acute or chronic, as the case may be, — and cholecystitis is but one manifestation of cholangitis.[1]

It does not seem necessary to quote further from our extensive notes to show how final are the conclusions of all competent modern observers that an infection is at the bottom of these diseases of the bile passages; but we must content ourselves with repeating again the fact, which practitioners constantly should bear in mind, that between primary infection of the gall-ducts and the actual formation of stones there elapses often a period of time measured by months, and punctuated not infrequently by a variety of symptoms.

Catarrh of these passages does not differ essentially from catarrh of other passages lined with mucous membrane. There is the invasion of organisms, congestion, exudation, desquamation.

With that picture in mind, it is well for a moment to give a thought to one feature of the anatomy, — the close relation of the common duct with the substance of the pancreas. Von Büngner of Hanau has lately published his observations upon the dissections of fifty-eight subjects, and notes that in fifty-five (nearly 95 per cent) the common duct passed through the substance of the pancreas. Only three times did it pass over the head of that organ. When it passes through the pan-

[1] Billings: "*Cholangioitis*, Inflammation of bile-ducts."

creas it is firmly imbedded in the gland tissue, and only with difficulty can it be dissected out. Furthermore, von Büngner observed that in one case only did the pancreatic duct (duct of Wirsung) join the common duct in the substance of the gland. In the remaining fifty-seven cases the two ducts opened independently into the ampulla of Vater, within the substance of the wall of the duodenum.

These two facts, thus recorded, have an important bearing on the pathology, as well as upon the operative treatment, of the diseases we are considering. The closely bound portion of the common duct within the pancreas is as inelastic almost as is the membranous urethra, and inflammation either within or without its lumen may readily lead to backing up, to stasis, and to jaundice. Stones will pass with difficulty through this constricted section, and the collections of mucus from the inflamed ducts above will also move through with difficulty, and painfully to the patient. Once past this portion, however, calculi find their next lodgement in the ampulla, with its narrow outlet into the intestine. They obstruct the pancreatic duct rarely, for, until the ampulla is reached, they do not commonly meet the pancreatic juice. Finally impacted in the ampulla, however, they plug the common outlet; but, unless large, they lie below the separate openings of the common duct and the duct of Wirsung, allowing the discharges from those two passages to meet and mingle above them in the ampulla itself. So it comes about that with variations of pressure the bile may now be forced into the pancreatic passages, or again, the succus pancreaticus may flow up through the gall-ducts

toward the liver. Opie has shown how this takes place, and it is one satisfactory explanation of the success of drainage of the pancreas undertaken through cholecystostomy.

Authors tell us that the great majority of gall-stones form without the patient's knowledge of discomfort, and that often the discovery of their presence is made at autopsy only, or in the course of operation undertaken for some other lesion. For instance, Riedel says that only about 5 per cent of those afflicted with gall-stones ever have occasion to consult a physician on account of their presence, and this statement is repeated by most writers on the subject.

From our own observations, we believe that such statements may be variously interpreted. The gall-stones, actually present as one result of the processes we have been discussing, may never have caused the typical pain or jaundice leading to their recognition, but other symptoms may have been present. We know that trouble in the bile passages is one of the common causes of digestive disorders, or that such trouble may be the result of processes in other organs giving rise to digestive disorders. The close anatomical association of the bile passages — especially of the gall-bladder — with the duodenum and stomach must not be forgotten, and internists, surgeons, and pathologists very well know that associated diseases of all these organs are common. Especially may one mistake duodenal ulcer for disease of the bile passages.

Kaufmann[1] makes some interesting observations in this connection. He asserts that hyperacidity and hyper-

[1] *American Medicine*, p. 792, Nov. 14, 1903.

secretion of the stomach play a more important rôle in gall-stone formation than is generally thought, and that in the history of gall-stone cases he often finds that for years before the occurrence of the first severe colic patients have complained of milder disturbances such as commonly are attributed to gastric hyperacidity. He goes on to reason thus, and the quotation is illuminating: "Since Naunyn's researches we have known that catarrh of the gall-bladder mucosa lays the foundation for the stones. This catarrh may be caused by a great many different disturbances of the abdominal organs. It stands to reason that hyperacidity of the stomach is particularly liable to lead to catarrh of the gall-bladder. The highly acid stomach contents must irritate the mucous membrane of the duodenum in the same manner in which they irritate the mucous membrane of the stomach. Experiments, especially those made by Russian investigators (Pawlow), have demonstrated that highly acid stomach contents upon reaching the duodenum may cause spasm of the pylorus. It may, therefore, be assumed that spasm of the opening of the choledochus is brought about by the same cause. Both the constant irritation to the mucous membrane of the duodenum and frequent spasms of the opening of the choledochus may lead to chronic catarrh of the gall-ducts and thus to the formation of gall-stones. When gall-stones are already present, the irritation to the duodenum by the acid stomach contents may bring on a gall-stone attack. In the interval between gall-stone attacks I have frequently seen symptoms of hyperacidity develop, which gradually increased in intensity, and were followed by a gall-stone attack."

These remarks of Kaufmann are interesting for many reasons. His assertion that gastric hyperacidity is frequently associated with gall-stone attacks corresponds with our own observations, and we will add the corollary that *disease of the bile passages, with or without gall-stones, is often associated with gastric and duodenal ulcer.* Which condition precedes the other is not always apparent, but it is certain that the two often are found together.

The old assertion, already quoted, that of all the persons with gall-stones only *five per cent* know it, is misleading for other reasons. One opens an abdomen in the dissecting room, and finds gall-stones in the gall-bladder; and one says, here is another case of unsuspected gall-stones. In the name of Truth, how can one confirm such an assertion? Yet that is the sort of thing one hears constantly. Most of these dead bodies come from the almshouses; probably no one knows their clinical histories. Again, as we must all admit, gall-stones and other bile-duct diseases may be, and frequently are, the source of grievous symptoms, attributed to disease of some other organ, — stomach, kidney, appendix. Those old figures and assertions are of very little value, and the fact upon which we must constantly insist is that disease of the bile passages is far more common than usually is apprehended, and that long before the stone formation has taken place or colics have occurred, one must be suspicious when hearing of such symptoms as discomfort, "all goneness," distress, anorexia, nausea, flatulence, constipation, malaise, malnutrition, continuous or frequently repeated and running over any considerable period of time. Such symptoms may

mean a variety of things, as we know, but very often indeed they mean trouble in the bile passages and are the precursors of the classical pain and icterus destined to follow.

Tenderness will usually be found in the right hypochondrium, over the ducts, the gall-bladder, or at a point sometimes called "Robson's point," midway between the ninth costal margin, and the navel, if the bile passages are at fault.

We must not be understood to maintain that infection and gall-stone formation may not take place without the patient's recognition of impaired health — for now we are encountering the personal equation, and statistics influenced by personal equations are constant *lusus naturæ*.

We suggest merely the various conditions which may complicate gall-stones. The variety of lesions is very great, and the symptoms correspondingly intricate. Firm adhesions may form between the bile-ducts or gall-bladder and the duodenum, so that there results a pyloric stenosis with gastrectasis. This is a condition not infrequently seen. When one finds a stomach dilated without obvious cause, he should look for a history and the physical signs of disease of the bile passages.

Again, adhesions about these parts may be so numerous and dense that the stomach is held high up against the left lobe of the liver, which in turn may be drawn downward.

Granted, now, that some sort of disturbance affecting the bile passages has begun, — the disturbance may be a simple primary catarrh or it may be an inflammation secondary to disease elsewhere, — how is one to know

that there is trouble? Why should one suspect it? Does it progress insidiously, leaving the patient free from symptoms for months and years or even for a lifetime?

About all that, and in spite of armies of statistics, we can give no definite answer, and we never shall be able to do so. For who indeed may tell? Certainly not armies of statistics. Until recently collectors of statistics were not concerning themselves with such elusive matters. Even now the inquiry is half-hearted or is neglected, and depends too largely for accuracy upon the personal equation of countless patients and numerous physicians. Moreover, we have yet much to learn about these diseases. Individual clinical experience and personal impressions must still be invoked largely, and though such sources of information are far from exact, they do furnish us with abundant food for thought. Take, for example, the partial experience of one of the writers of this book. Since his taking up this line of inquiry he has had to deal in *private practice* with twenty-four cases of operation for bile-duct disease. All of these persons have been cross-examined repeatedly and carefully. In not a single case was it certain that the final and convincing symptoms appeared suddenly and without premonition; that is to say, those final symptoms which led immediately to the operation. To be sure, there was no uniformity in these histories, but in all the cases there had been some symptoms of faulty digestion running often over many years.

Here is one common symptom, — common, but suggestive: a small and quickly appeased appetite associated with a tendency to corpulence. We have seen this

association in several cases, and have come to regard it as significant. There are usually other symptoms, — constipation, occasional distress after food, indefinite but sharp occasional pains in the upper part of the abdomen; a bad taste in the mouth, furred tongue, sometimes nausea, frequent headaches, lack of vigor, exhaustion after slight exertion, diminished diaphoresis, high-colored urine, and frequent blurring of vision. Such patients will tell you that they are "bilious."

When one has to deal with a "bilious" patient, he should bear in mind that the true condition may be an infection of the bile passages, and that the man may some day be seized with the classical symptoms of gall-stones; indeed, the stones may even now be present. These bilious folk usually are victims of a defective metabolism. Their digestive processes frequently are at fault; fermentations take place in their intestines and auto-infections result. They may be sufferers from sundry "neuralgic" or rheumatoid pains, — sciatica, lumbago, "stiff neck"; they may experience attacks of arthritis. We used to call such things "rheumatic fever." These are the people to whom the old clinicians assigned "diatheses."

Of course, these symptoms may be present in varying combinations and degrees in different patients. But what is the physician to do? He should bear in mind, to begin with, that these are the cases cured commonly by internal treatment. Such patients are those who are suffering from lack of proper drainage of the bile passages, and to remedy that lack must be his first endeavor.

In this discussion it is needless to dwell *in extenso*

upon details of such treatment. Much of it is summed up in the word "Carlsbad": change of air and scene, recreation, a carefully regulated life, a restricted diet, exercise, massage, proper bathings, and the abundant drinking of saline waters.

The effect of all this is obvious enough. The patient's general condition is improved, the systemic circulation is stimulated, and the affected parts are flushed. Hyperæmia is diminished, catarrh is relieved, local swelling subsides, normal drainage of the ducts is reëstablished. In a few weeks the sufferer is well. With proper care and some attention to the conduct of his life after that, he may continue indefinitely in good health.

Such, in brief, is the story of thousands of Carlsbad patients, — of the "bilious" and "rheumatic" who seek the Carlsbad treatment. But who may say that without such treatment they would not have lived to become the victims of gall-stones? And one must keep in mind always, in such cases, the reservation that gall-stones already may have formed, but have produced no diagnostic symptoms.

There is another large and familiar class of cases, — those with gall-stones known to be present, but giving little trouble. Writers tell us that the great majority of gall-stone patients are not subjects for surgery. These are the patients who have given Carlsbad its fame. Of such cases countless "cures" are reported, but we must not let such talk stagger our intelligence. For here, again, what man positively may tell the facts?

We have discussed a class of cases, which, for convenience, we have called the "bilious." From the

clinician's viewpoint they may differ from this second class of obvious gall-stone cases, but for the pathologist there is no sharp dividing line. Clinically, by treatment, the second class may be relegated to the first class, and a cure established; but, as a fact, there is no evidence that any such "cure" has removed the stones. This consideration, however, must not lead us to consign all these mild gall-stone cases to the operating table. By the Carlsbad method, thousands may be relieved and enabled to lead comfortable lives. It is for the internist and the surgeon together to weigh each case and to decide upon the proper course.

The effect of Carlsbad treatment in this second class of cases is quite similar to what it is in the first class. Inflammation is subdued, a condition more free from infection is gained, natural drainage of the passages is secured. But the stones remain. Of that there can be no doubt in the vast majority of cases. Of course it is possible that, with the free opening of the ducts, small stones may escape and an anatomical cure result, but we have no evidence that this is a frequent outcome. Commonly, stones remain behind. They may lie there quiescent for years; they may at any time prove a source of trouble. They are always infected, probably.[1] Perhaps it is best to leave them alone. Most patients think so, and many physicians.

But there are recurrences of severe pain often after a cure is said to be established. What shall one do then? Authorities differ about that question. It is

[1] "Terrier states that he has proved organisms (both *B. Coli Commune* and streptococci) to be present in all cases of inflammation of the bile passages."— "Gall-bladder and Bile-ducts," p. 83, Mayo Robson.

our conviction that such cases should be treated like cases of chronic appendicitis, and that a radical operation should be done.[1]

Very briefly let us consider some of the conditions for which we may be justified in passing by operation and resorting to internal treatment.

If the attacks are mild and infrequent and there is complete latency between them, we may hope to get along without operation. These are the ideal cases for further Carlsbad treatment, and we may count with much confidence on prolonging health and comfort indefinitely by such a course.

Then there are those cases such as Kaufmann and Ochsner describe, — cases with prominent gastric symptoms with pronounced hyperacidity. Absolute rest of the stomach with frequent gastric lavage, followed by a course of Carlsbad, will often allay entirely the symptoms. In such cases we have seen the benefit, in a number of instances, of the cold abdominal pack and large, high, cold enemata as advised by Pfaff.

Another familiar condition in which operation may be avoided is that described by Kehr. In this the attack was an old one, quickly passed, and leaving no pain or tenderness in the gall-bladder region, but dyspepsia persisted. In such a case of course internal treatment is indicated.

All reliable authorities are agreed that in an *acute* case, with complete occlusion of the common duct, it is

[1] Kehr says: "In many cases of stone in the latent stage, rest and alkaline treatment are effective. Especially in the recurring cholecystitis is the Carlsbad or Neuenahr water effective." He doubts, however, if often a permanent cure can be established by this method when stones are already formed. Such are Ewald's views also.

best to delay operation and employ medical treatment. If the condition persists, however, with the development of a systemic infection, we must operate.

Then there are many cases of cholangitis, with or without a cholecystitis, in which it is well to rely for a time on medical treatment. By such means, when free natural drainage is established, the symptoms subside, and the patients may regain permanent health. Here, again, however, one must watch the case carefully, prepared to operate and institute drainage through cholecystostomy if convalescence is delayed.

Such, in general terms, are the cases in which we may avoid or delay operation.[1] They represent the great majority of diseases of the bile passages, and when we come to sum them up, what do they mean? That most cases are mild; that we have a first class in which there is no definite evidence of stones, a second class in which the infection and the stones give no great or constant trouble, and that in both of these classes we may avoid operation.

There is a small third class of diseases of the bile passages in which operation must be our resort. This class is estimated variously as embracing from 5 to 10 per cent of all cases of bile-passage disease, but it is the class which tries our resources.

Writers have attempted to divide this class into "Calculous Diseases" and "Inflammatory Diseases." One cannot do that. We know that calculi are due to infections; but who is to say always whether or not, in a given case, calculi complicate an infection? The

[1] There is no convincing evidence that drugs dissolve calculi. Deep massage of gall-stones is dangerous.

difficulties of an accurate anatomical diagnosis before opening the abdomen are insuperable, consequently the text-book summing up of pathological conditions which demand operation is often clinically impossible. We can, however, in somewhat general terms discuss briefly the problem and attempt to say what should be done in any given case.

Mayo Robson gives seventeen reasons for operating on the bile passages.[1] Some of these reasons overlap each other, but quite fully they cover the ground. They may with advantage be condensed into three groups. There is, *first*, that type with "frequently recurring biliary colic without jaundice, with or without enlargement of the gall-bladder." That is the condition probably for which most commonly we operate, but it is not always easy to distinguish this from that condition described above for which we send the patient to Carlsbad. The difference is one of degree only, and it is especially in the consideration of such cases that experience counts. In general terms, if such a case is mild, and the man is holding his own, try Carlsbad; if he is failing, operate.

If a patient has an attack of pain followed by jaundice, and then recurring pains, look for stone in the common duct, and operate. The above two conditions are common. They deal obviously with stones.

In a *second* operative class is a group of cases in which the *inflammatory* symptoms are the more apparent. Mayo Robson says operate "in enlargement of the gall-bladder without jaundice, even if unaccompanied by great pain." That means usually that we are dealing

[1] "Gall-bladder and Bile-ducts," pp. 243–244 (third edition).

with some form of obstruction to the cystic duct. It may mean empyema of the gall-bladder.

When we suspect a phlegmonous cholecystitis or gangrene, a rupture of the gall-bladder, or an infective or suppurative process with constitutional symptoms, we must operate.

In the *third* place, there are those symptoms pointing to an involvement of other organs or of the tissues outside the bile passages. Again we must operate, — in peritonitis starting in the right hypochondrium; in the case of localized abscess; to relieve painful adhesions and to cure the various fistulæ which may have formed.

Of course, traumatic lesions, stabs, or shot-wounds in the right hypochondrium must be explored and repaired.

Primary tumors of the gall-bladder region, provided there be no metastasis, must be removed.

And diseases of the pancreas secondary to disease of the bile passages must be treated by appropriate operative measures.

Such are the leading indications for operation. The conditions may appear clean-cut or they may be obscure. Often they are extremely complicated; nearly always they mean disease of long standing. Often they present technical problems of extreme difficulty which call for the greatest ingenuity in their solving. They are never lightly or unadvisedly to be undertaken, and they carry with them the familiar old surgical lesson of neglected opportunities. The details of such operations we will discuss in the next chapter.

Cancer of the bile passages is not uncommon. Let

us give it some serious thought here. That traumatism has a definite place in the etiology of malignant disease most observers are agreed. In so far we have returned to the beliefs of the old masters. The relation of cancer to gall-stone disease appears to be as frequent and as close as to chronic gastric ulcer. So here, again, we have an interesting interdependence or correlation of conditions. Inflammations of the bile passages are found associated with duodenal and gastric ulcer. Such ulcers are frequently the forerunners of malignant disease, and gall-stones are found associated with cancer of the gall-bladder, liver, stomach, and pancreas, while all these structures and conditions, so closely related, centre about the duodenum, as we have pointed out.

Bevan alone, among authorities on this subject, questions the dependence of gall-bladder cancer upon calculi, for he says that he has seen little evidence pointing to gall-stones as a factor in producing cancer.

Conversely, W. J. Mayo's observations are interesting: out of five hundred and thirty-four cases of bile-passage disease he found cancer in twenty-four, or more than 4 per cent, and he goes on to say, "As the presence of gall-stones occurs in only 15 per cent of secondary cancers of the gall-bladder, and in over 90 per cent of primary cancers, we must conclude that they are the chief etiological factor in the production of malignant disease of the organ." He remarks, further, that gall-stones are present in nearly all cancer cases, though the stones may have been quiescent for years.

Other writers have found the proportion of cancer in bile-passage diseases to be much higher than Mayo's 4 per cent. J. T. Rogers, writing in the *St. Paul Medical*

Journal,[1] says that malignant disease occurs in about 10 per cent of the cases, and observes that primary malignant disease of the gall-bladder is not the rare condition it was once supposed to be, and that the presence of gall-stones predisposes the patient to malignancy. He states very truly, also, that the diagnosis of early cancer is almost impossible, "but if we are constantly on the lookout, and realize that according to Schröder 14 per cent of the gall-stone cases suffer at one time from cancer of the biliary passages, and Naunyn believes that half the cases of chronic jaundice diagnosticated as cholelithiasis are complicated with cancer, or are due to cancer alone, the diagnosis can oftener be made." Kehr, Robson, Ewald, Musser, and Hoppe-Seyler bear similar testimony.

The purpose of this argument is to urge the wisdom of operation in *established and persistent* disease of the bile passages, on account of the chances (fourteen (?) in one hundred) of later malignant development.

As for the diagnosis of cancer of the bile passages, that is quite another matter, — usually very difficult. The problem is similar to that of gastric cancer. One can rarely make a diagnosis of primary gall-bladder cancer early enough successfully to remove the growth; therefore, shall one not explore early for diagnosis?

As one may not expect to make an early diagnosis of cancer of the bile passages, what is one to do? In the first place, bear in mind always the considerable probability that cancer may develop in any case of disease of the bile passages. If relief from symptoms and a return to health are not secured after two months of

[1] Volume for 1903, p. 828.

Carlsbad treatment, exploratory operation should be performed. Obstinate slight jaundice should arouse suspicion, and with this jaundice there may be no pain associated — or there may be constant, slight, or gnawing pain, but no colic. A hard tumor of the gall-bladder, when felt, may confirm the diagnosis of cancer; but it must also confirm the belief that it is too late to save the patient's life by operation. A common source of error lies in the possible presence of a mass of inflamed viscera matted into a tumor.

There is a sign of considerable importance, however, — a gall-bladder enlarged by retained fluid, permanently enlarged, not transiently. This is a condition frequently misinterpreted. Courvoisier explained it.[1] R. C. Cabot summarizes his observations as follows: "When the common duct is obstructed by a stone, dilatation of the gall-bladder is rare. When the common duct is obstructed by other causes, dilatation of the gall-bladder is common." Mayo Robson puts the case in these words: "Jaundice with distended gall-bladder is presumptive evidence in favor of malignant disease; but jaundice without distended gall-bladder favors the diagnosis of cholelithiasis."

The explanation of such well-recognized facts is obvious enough. Every surgeon experienced in these operations knows that stones rarely plug completely and permanently the common duct, for the duct becomes greatly distended, as a rule, and stones move about in it, — the "floaters" described by Fenger. With cancer the duct is permanently and continuously

[1] See an interesting essay on "Courvoisier's Law," by R. C. Cabot, *The Medical News*, Nov. 30, 1901.

obstructed. Whether or not cancer is present, there may be an inflamed and thickened gall-bladder, incapable of distention, in which case Courvoisier's law would fail to become operative. In other words, for the successful working of the law we must presuppose a comparatively normal gall-bladder, — a condition by no means always present. The law is interesting and valuable, however we must discount its negative evidence; but its positive evidence — a permanently enlarged cystic gall-bladder — is of great value.

Further evidence in making our diagnosis of cancer is cachexia and the progressive general symptoms common to all malignant disease.

Cancer of the bile passages secondary to cancer of the stomach and other organs is a common affliction, and a possibility always to be recognized by the surgeon; but its consideration need not detain us here. Operative measures for its removal must be futile. Operation for the relief of symptoms, for drainage, and for anastomosis may occasionally be justifiable, and with such procedures we will deal later.

Up to this point our discussion has led us to the following conclusions: —

(*a*) Disease of the bile passages begins with inflammation, and leads to tissue changes as well as to the formation of gall-stones.

(*b*) The great majority of diseases of the bile passages may be relieved or apparently cured by internal treatment.

(*c*) A small number of cases (10 per cent?) do not recover under internal treatment; but, owing to ex-

tensive tissue changes and the permanent lodgement of gall-stones, require operation.

(*d*) Malignant disease is a common result or complication of disease of the bile passages. The possibility of its development should be borne in mind constantly, and more frequent early operations should be done with a view to anticipating its development.

In the next chapter we shall consider the various operations upon the bile passages.

CHAPTER IX

SURGERY OF THE BILE PASSAGES

When one considers the question of how to operate in disease of the bile passages, one finds in the analysis of cases and the experience of many operators that certain clearly defined and fundamental principles become salient, — principles as old as surgery. These biliary diseases are infectious in their origin, and in operative treatment one must employ the sound and ancient maxims applicable to the treatment of all infections. In dealing with a carbuncle or a palmar abscess, one removes the offending material and drains the parts; he drains until all possibility of reinfection has been eliminated.

In applying those same sound principles to infection of the bile tracts, it is possible to meet all the problems of this often obscure and much debated subject by formulating and observing the following three rules: —

1. Remove stones.

2. Remove, so far as possible, all disorganized, degenerated, and permanently crippled tissue.

3. Drain.

In special cases, of course, the intelligence of the surgeon may prompt him to modify or depart from these rules. The condition of the patient may not permit of a radical operation at one sitting; malignant involvement of the parts may render impossible com-

plete removal of the disease; extensive adhesions and associated, complicating disease of other organs may prohibit more than palliative measures, — but always one should keep in mind and aim to observe those three cardinal rules.

The thought of operative treatment for gall-stones is nothing new. We must credit Dobbs, Sims, and Kocher with the pioneer work in modern surgery of the bile passages, but it is only within the last ten years that definite progress has been made and an intelligent technique evolved out of countless operations and a multitude of writings.[1]

At present the debate, such as it is, centres around the questions: when shall we operate? shall we remove the gall-bladder or drain it? shall we remove stones whenever present? shall we drain the hepatic duct? shall we ever omit drainage of the operative field? how shall we avoid hernia?

That question, *when to operate*, has been discussed at some length in the previous chapter. Let us then turn to a consideration of the other leading questions.

The discussion of *cholecystostomy* and *cholecystectomy* was waged for a number of years, and a multitude of papers bearing on the subject may still be read with interest and profit. Enthusiasm almost to the verge of acrimony was displayed at times, and the points of view

[1] "The surgical treatment of gall-stones was inaugurated by Sharp and Monaud (according to Gottfried Müller and Petit). Bloch, in 1774, proposed the artificial formation of adhesions in the region of the gall-bladder. Chopart and Désault, F. A. Walter, and Richter improved these methods. Herlin, L'Anglas, and Duchainois studied the ligation of the cystic duct and the incision and extirpation of the gall-bladder as early as 1767." — Hoppe-Seyler in Nothnagel's "Encyclopedia," "Diseases of the Liver," p. 530.

of sundry writers often were so divergent that it seems as though their premises were too dissimilar to admit of arriving at the same conclusions. Starting with the proposition that cholecystostomy is simple, safe, and easy, the advocates of that procedure wished to apply the principle practically to all operations on the bile passages; while those who favored cholecystectomy averred that the gall-bladder is analogous to the appendix, and that, when involved in disease, it should always be removed.

We have now learned that there is a distinct place for both operations, though at times, in a given case, the conditions are so intricate and the indications so overlap each other that it may be difficult for the experienced surgeon even to be sure of which procedure to follow.

Owing to such uncertainty in past years, uncertainty leading often to blind groping, the statistical results of much of the surgery of these parts were extremely variable, — often surprisingly good, often shockingly bad. To-day, with the great experience which every large surgical clinic can furnish, it seems incredible that results so bad as were known a few years ago ever could have been condoned. That is beside the mark. Only by the struggles through which former operators passed have we been able to reach our present more sound and intelligent position.

Statistics of sundry operators are unsatisfactory also, for we lose the personal equation. The statistics of an operator of six or seven years ago may not in fairness be compared with the statistics of the same operator, or even of a younger operator, of to-day, and the desperate

chances taken by one man may be shirked or wisely avoided by another.

Not long ago F. Winslow of Boston collected into a valuable paper, as yet unpublished, the statistics of operations on the bile passages performed by a variety of surgeons at the Massachusetts General Hospital. Beginning with the year 1894 he traced the histories with the *end-results* of three hundred cases. Many of these operations were done in the early days, and if one were to study their records, one would find much to censure. During most of that time, when it came to dealing with the gall-bladder, cholecystostomy was the favorite operation. There were nearly four times as many cholecystostomies as cholecystectomies. Without a knowledge of actual conditions in individual cases, a comparison of figures and an estimate of the value of any operation is futile; nevertheless, the following figures have their interest: —

WINSLOW'S FIGURES

	Cholecystostomies	Cholecystectomies
Total cases	170	44
Traced cases	128	38
Good results	46 – 35.9 %	25 – 66.9 %
Poor results	59 – 45.6 %	4 – 10.5 %
Deaths	23 – 17.9 %	9 – 23.6 %
Hernias	4 – 3.1 %	0

Contrast that table with the later statistics (of the Mayo brothers) published in 1903. W. J. Mayo [1] reports three hundred and forty-two cholecystostomies with eight deaths, a mortality of 2.3 per cent; and sixty-six chole-

[1] *Boston Medical and Surgical Journal*, Vol. CXLVIII, p. 545, 1903.

cystectomies with two deaths, a mortality of 3.03 per cent. His "mortality" shows a great improvement over Winslow's figures, but it is interesting that the percentage of deaths following the two operations — cholecystostomy and cholecystectomy — respectively is in about the same ratio in both sets of statistics.

In that paper of his, Mayo does not deal with the question of end-results, so that we are unable to make an extensive comparison of the subsequent histories in the two sets of cases. Mayo's death-rate however is so greatly lower than that recorded at the Massachusetts General Hospital that we must assume for it some cause other than unsatisfactory pioneer work in the latter case. One salient cause for Mayo's better showing is probably the fact that competent operators in their private clinics can make a better choice of material and are likely to encounter fewer desperate cases than fall to the lot of surgeons doing routine work in a great municipal hospital. As a matter of fact, from inquiries among surgeons of the Massachusetts General Hospital staff, we find that their experience in private operating shows a mortality markedly lower than the hospital mortality.

Other writers give a mortality so variable for these two operations of cholecystostomy and cholecystectomy that it is difficult to make any comparison between clinics. We can say that complicated operations give a high mortality in the hands of all surgeons; that simple operations give a low mortality; that the mortality when cholecystectomy has to be done is slightly higher than when cholecystostomy is done, because conditions necessitating the former operation are the graver; and that the statistics of all surgeons are improving

with increased experience, a better appreciation of indications, and an improved technique.

Here is a short table showing the results of sundry men. It is arranged chronologically.

		Cholecystostomies		Cholecystectomies
		Mortality		Mortality
1890	Courvoisier . . .	21.14 %	1890	25.5 %
1893	Martig . . .	17 %	1894	17.24 %
1896	Kehr	6 %	1894	5 %
1900	Délagenière . .	——	1900	23 %
1901	Terrier . . .	——	1901	25 %
1902	Kehr	2.1 %	1902	1.1 %
1904	Robson . . .	2.7 %	1904	6.2 %

After reading such a set of figures, one thinks he sees very convincing facts, but when he comes to analyze the reports he despairs of statistics; for then he observes at once — indeed, the reporters distinctly state — that here are various types of disease, some indiscriminately mingled, some carefully separated. Take, for instance, those figures attributed to Kehr in 1902: Stern, Kehr's pupil, tells us that Kehr had two hundred and thirty-seven 'cystostomies with five deaths, — a mortality of 2.1 per cent; while Robson quotes Kehr, "but the complicated cases, including malignant disease, had a mortality of 97 per cent." Robson concludes, "Cholecystectomy has hitherto undoubtedly been a more serious operation than cholecystotomy [cholecystostomy], but since the method of complete exposure of the operation area has been adopted, it has been rendered both easier and safer."

As we have insisted, such a statement as that last of Robson is open to endless discussion, for safety

and ease depend on the conditions presented by individual cases. At any rate all the figures at hand seem to prove that such cases as have been submitted to cholecystostomy show a slightly lower mortality (dependent again on the severity of conditions present) than do the cases treated by cholecystectomy.

A fact more interesting and significant than that of mortality is the permanence of cure. Winslow's figures give us information on end-results, and his findings resemble those given in Robson's latest elaborate tables. Winslow found that of the cholecystostomies 35.9 per cent showed good results, while 45.6 per cent showed poor results. On the other hand, of the cholecystectomies, 66.9 per cent were permanently cured, and only 10.5 per cent had recurrences, or continued to suffer. It should be recognized, however, that "poor result" is a flexible term, and that many of those unfortunate ones were much better off than before operation, — whether 'cystostomy or 'cystectomy was done.

Bearing in mind, now, our three cardinal rules, let us see how we can apply them in given cases, — as to the choice of 'cystostomy or 'cystectomy.

If we find no damage to structure, our indications are plain enough: drain the gall-bladder. The various writers on the subject have formulated their ideas regarding the indications for *'cystostomy*, and the evidence is convincing that there are three classes of cases in which that operation generally is indicated: —

(*a*) When the gall-bladder and ducts, though containing stones, are not crippled by the inflammatory process.

(*b*) When acute inflammatory processes exist, with or without the presence of stones.

(*c*) When the common duct is obstructed by unremovable malignant disease.

As an example of class (*a*), we may take the familiar one, a freely movable, normal-appearing gall-bladder, full of faceted stones — the cystic duct free or containing only small movable stones. In such cases removal of the stones, followed by drainage, will result surely in restoring the parts to the normal.

Sometimes, rarely, when the patient is too exhausted to endure a long, severe operation, a 'cystostomy preliminary to 'cystectomy may be unavoidable.

Class (*b*) furnishes a great variety of cases suitable for 'cystostomies. It is a complicated class. While class (*a*) deals with the simplest of stone cases, we may call class (*b*) the inflammation class.

In empyema of the gall-bladder, without disorganization of that viscus, 'cystostomy is indicated; also

In certain cases of chronic catarrh of the gall-bladder or bile ducts,[1]

In infective cholangitis,

In obstruction by hydatids,

In hydrops of the gall-bladder (not due to stricture of the cystic duct),

In some cases of phlegmonous cholecystitis accompanied by great prostration.

The conditions just described call for 'cystostomy because serious infections demand imperatively thorough drainage, with the minimum of risk to the surrounding parts.

As for class (*c*), it must be obvious that with an obstructive jaundice due to tumor occluding the ducts a 'cys-

[1] Robson.

tostomy, or sometimes a 'cystenterostomy, is essential for permanent biliary drainage.

Except in the case of malignant disease, cholecystostomy, done for the conditions described above, gives a low mortality and a large proportion of permanent cures. Such are the conditions for which experienced surgeons are now doing the operation, the effect of which is that by observing our first and third cardinal rules the parts are restored to their normal condition, and interrupted function is resumed.

When we come to the indications for *cholecystectomy*, our course is by no means always so safe and easy. There are two conspicuous indications for that operation : —

Class (*d*) Disease crippling the cystic duct.

Class (*e*) Disease crippling the gall-bladder.

These two conditions — (*d*) and (*e*) — often are interdependent, often are present together. We are now within that field of extensive associated lesions which furnishes the text upon which this book is built. When the gall-bladder is inflamed, thickened, ulcerated, necrotic, disorganized, we must expect and look for extensive disease, — erosions and stricture of the cystic duct; inflammation and dilation of the hepatic and common ducts; sometimes adhesions and ulcerations, with fistulæ into neighboring organs; obstruction at the ampulla of Vater with involvement of the pancreas in the general inflammatory process; even disease of the liver and at times duodenal ulcer, gastric ulcer, pyloric obstruction, and eventually cancer, as the result of the long-continued disease.

Such are the conditions calling for the application of all three of our cardinal rules, and especially of rule

two, "Remove, so far as possible, all disorganized, degenerated, and permanently crippled tissue." That means 'cystectomy. A diseased gall-bladder, thickened, inelastic, ulcerated, adherent, contracted, is functionally useless; it may remain a nidus of infection.

Serious damage to the cystic duct, even if other parts are unimpaired, renders the gall-bladder relatively useless.

Ulceration of the duct means cicatrices, kinks, twists, stricture, occlusion often, with hydrops of the gall-bladder, or chronic catarrh and future destructive processes.

So with damage to "cysticus" or gall-bladder, 'cystectomy is essential; 'cystostomy would result only in palliation and future trouble.

As examples of class (*d*) we may have stricture of the cystic duct,

Mucous fistula, due to stricture of the cystic duct,

Hydrops of the gall-bladder, *due to stricture of the cystic duct*, and certain other cases in which the gall-bladder is very much dilated.

As for class (*e*), in that are to be found the manifold conditions involving structural damage to the gall-bladder. With or without the presence of stones, — for stones often are an incident merely in the course of the disease, — we may find phlegmonous cholecystitis and gangrene of the gall-bladder. In class (*e*) we may find also

Multiple and sometimes perforating ulcers,

Chronic cholecystitis with contracted gall-bladder, or possibly a gall-bladder enlarged, thickened, ulcerated, while the common duct is unobstructed. There are, too,

Those cases of empyema of the gall-bladder in which there is serious damage to structure,

Cancer or other tumors limited to the gall-bladder, and

Calcareous gall-bladder.

We shall have a few words to say, shortly, about the method of removing the gall-bladder; but here and now we insist upon the essential importance of *drainage* in all operations upon the bile passages. The surgeon is dealing with an infection, and he can never be certain that with the tying off of the cystic duct some leakage may not take place. A rubber tube rolled in gauze or otherwise protected by gauze always should be sewed with catgut into the stump of the duct.

The two operations — of cholecystostomy and cholecystectomy — are by far the commonest which the surgeon must employ in dealing with the bile passages; but there are others.

Cholecystendysis is an antiquated procedure. It used to be called "the ideal operation." It consisted in a preliminary cholecystostomy, then in sewing up the opening in the gall-bladder, dropping it back or anchoring it to the abdominal wall, and closing the external wound. Sometimes the gall-bladder leaked, and the patient died of peritonitis. No one does cholecystendysis nowadays.

Choledochotomy and *choledocholithotomy* are words sometimes used by writers. Obviously they mean opening the common duct and removing stones. The manœuvre is given the dignity of a little historical sketch by Robson, and is ranked as a distinct operation. Before the development of latter-day technique it de-

served to be so ranked; but it is common enough at the present time, and is now merely a detail in the general operation of clearing the bile passages.

Cholecystenterostomy is what its name implies. An opening is made between the gall-bladder and the bowel, — duodenum, jejunum, or colon. The operation is employed when bile is unable to reach the duodenum, owing to irremovable obstruction in the common duct. A sound gall-bladder is needed to insure success.

The indications for the operation must be obvious to any one familiar with the mechanics of the situation. Robson gives the following rules: —

Cholecystenterostomy is indicated, —

"1. In biliary fistulæ depending on stricture in, or other permanent occlusion of, the common duct.

"2. Very occasionally in cancer of the head of the pancreas, or malignant tumor of the common duct. . . .

"3. Very occasionally in impaction of gall-stones in the ducts, where the common bile-duct cannot be freely exposed and the patient is not in a fit condition to bear the more prolonged operation. . . ."

Obviously, contraindications are: —

"1. In any obstruction of the bile-ducts which can be cleared away with any reasonable probability of success.

"2. In malignant disease of the head of the pancreas or common bile-duct leading to distention of the gall-bladder, the mortality is so great that it is hardly worth incurring the risk, unless the patient be in a very good condition.

"3. In contracted gall-bladder, where it is impracticable to insert the button or bobbin.

"4. In very large gall-bladder, with obstruction of the cystic duct, when cholecystectomy should be done."

Choledochenterostomy is, of course, a substitute for cholecystenterostomy. It is done for much the same conditions. When the gall-bladder itself, owing to impairment of structure, cannot be utilized, the anastomosis is made between the common duct and the bowel.

Earlier in this chapter we stated that we should consider the question of whether or not to remove all stones whensoever found, of drainage of the hepatic duct, the omission of all drainage at times, and the question of avoidance of hernia. Such matters will be discussed in the following paragraphs, but in connection with the broad general subject of *technique*. The method of approaching and conducting operations on the bile passages is a subject of historical as well as immediate interest; and if one had the time and patience, the tale would prove an attractive study. Literature on the subject is enormous; a mere enumeration of the writers would fill several of our pages. The names of a few of the older authors have been mentioned; while to-day we hear most frequently of Beck, Bevan, Brewer, Cushing, Da Costa, Fenger, Franke, Halsted, Kehr, Lejars, Martig, Mayo, Mixter, Moynihan, Richardson, Riedel, Robson, Schröder, Terrier, Weir, and Witzel.

Not long ago Howard Lilienthal[1] published an excellent modern description of cholecystectomy, — a de-

[1] *Annals of Surgery*, July, 1904.

scription which does not differ essentially from that now given by many surgeons. It is difficult here to avoid plagiarism. Let us take up first a variety of considerations dealing with the broad subject of operations on the bile passages: the preparation of the patient, instruments, and sponges, the question of bleeding in jaundiced patients, the position of the patient during operation, the character of the incision, the exposure of the passages, the method of draining the gall-bladder, the method of removing the gall-bladder, opening and treating the ducts, methods of reaching the ampulla, complications, pancreatic disease, pyloric disease, the management of tumors.

The question of preparing the patient presents one or two points of special interest. It is needless to dilate upon the ordinary details of preparing the room, the skin, etc., but attention should be paid to care in anæsthesia, to stimulation, and to avoidance of hemorrhage. Many of these patients are very ill, exhausted by pain and starvation; the anæsthetist should be specially skilled.

Stimulation should be begun at least twenty-four hours previous to the operation. We know of nothing better than strychnine, gr. $\frac{1}{40}$ every four or six hours. An infusion of normal salt solution, after anæsthesia is complete, is important if the patient is feeble; and the stomach should be washed out with sterile salt solution half an hour before the operation, when there is any question of gastric or duodenal complications.

Dealing with hæmophilia, especially when there is jaundice present, is important. If disease of the passages is of long standing and jaundice is chronic,

there is decided danger of obstinate, oozing, capillary hemorrhage. This is especially true when the pancreas is found involved during the operation. To obviate the danger of bleeding, various methods and remedies have been employed. Of these there is good reason to believe that calcium chloride is one of the most effective. We have found it so in our own experience, while it is recommended as a routine by Robson, who quotes with approval the work and reports of Wright (*British Medical Journal*, Dec. 18, 1891) and of Bertignon (*Medical Press*, Nov. 23, 1902). We have followed Robson's method and agree with him that large and repeated doses are required in order to obtain good results, — calcium chloride in 30-grain doses by the mouth three times daily for two or three days before the operation, and afterward in 60-grain doses by the rectum three times daily for two or three days, or longer if necessary.

As for instruments and sponges, there is needed, besides the ordinary laparotomy set, two or three good gall-stone scoops, — nothing more than this usually; and gauze sponges of assorted sizes, — especially some very large pieces of gauze, resembling in size small bath towels. These are extremely useful for checking capillary hemorrhage.

As for the position of the patient during operation, it has been found that some sort of pad or pillow beneath the back, in the lower dorsal region, greatly facilitates exposure of the deeper parts of the field. By its use the ducts seem to be thrown forward and the lower abdominal viscera apparently fall away. Various modifications of this pad or support have been devised,

—the best that we have seen is that in use at the Mt. Sinai Hospital in New York. This consists of a short, enamelled, movable iron slab, set edgewise in and across the table, and caused by a ratchet to rise and fall, as needed, beneath the patient's back.[1]

The question of what incision to use in operations on the gall-bladder has been much debated; but most surgeons now enter the abdomen through a long incision, splitting the right rectus muscle, and we believe it is good practice, when enlarging this incision, to carry it up in the interval between the xiphoid cartilage and the right costal margin as high as possible. The upper surface of the liver will thus be exposed freely, and, as Robson points out, by lifting the lower border of the liver, in bulk, and rotating it (if needful first drawing the organ downward from under cover of the ribs), the whole of the gall-bladder and the cystic and common ducts are brought near to the surface.

M. H. Richardson has felt for some years that the method of opening extensively the abdominal cavity involves risk of subsequent hernia, and in a valuable paper, read before the American Medical Association, in 1904, he urged the advantage of entering the abdomen by a muscle-splitting operation after the manner of the "McBurney incision" for appendicitis. Just how valuable an advance in the surgery of the bile

[1] Lilienthal describes this device as follows: "The operation has been greatly simplified by the employment of an operating table with an enamelled iron piece about six inches wide, which may be raised or lowered by means of a crank, so as to serve instead of a sand-bag or pad under the patient's back. This device permits one to hyperextend the patient to any desired degree of lordosis. The gain in accessibility is really most remarkable."

passages Richardson's method may prove, is doubtful. The careful suturing of the present day and gall-bladder drainage through a separate stab wound have greatly reduced the chances of hernia. Another and an important advantage of the long incision near the median line, together with the extensive exposure of the ducts, is that exploration of adjacent organs is thus rendered easy, and supplementary operations are facilitated.

As for the question of method in cholecystostomy, we believe that the employment of the so-called Mixter tube, in common use at the Massachusetts General Hospital, has material advantages. The Mixter tube is a short glass cylinder merely, from three to six inches long, as desired; from a quarter to a half inch in diameter, non-fenestrated, and with a flange at one end, — in other words, it is a glass drainage tube with a flange. As used for cholecystostomy, this tube, flange end downward, is inserted into the opening in the gall-bladder and is tied tightly in place with a silk or catgut ligature, about the gall-bladder and above the flange. One or two gauze wicks are wrapped about the tube to prevent possible leakage. The ends of the ligature are left long and carried outside the abdomen. The gall-bladder is dropped into its normal position, the tube is carried outside, and to it is attached a long rubber drain with a collecting bottle.

The advantage of the Mixter tube is that with it no suturing of gall-bladder to abdominal wall is required, with the result that by just so much the danger of a mucus fistula is diminished, — granted, of course, that the ducts be free from stones. At the end of five or six days the wicks are removed; at the end of eight or ten

days the ligature at the knot is cut away from the tube, by means of a sharp-pointed bistury, and the tube is withdrawn. A long, narrow tract completely shut off by adhesions remains. It shrinks rapidly and closes entirely after a few days.

In the experience of the writers it is an advantage to establish this gall-bladder drainage through a separate stab wound, opening outside of the linea semilunaris. The long abdominal incision may then be closed, thus reducing danger of hernia to a minimum. In a considerable number of cases, so treated, we have seen no subsequent hernias.

Cholecystectomy is well performed in uncomplicated cases after the method described by Lilienthal. That writer's description is so satisfactory that we take the liberty of quoting it at length:—

"The gall-bladder, having been located, is drawn toward the external wound. If the viscus is very tense or is supposed to contain infectious fluid, it is isolated by gauze packings, and aspiration is performed in order to empty it as completely as possible. When the walls seem very friable, it is even wise to incise and empty the viscus, closing the opening by ligature or clamp before proceeding with the extirpation. The gall-bladder is usually quite a tough organ, and in the majority of cases it may be grasped with an ovarian ring-clamp applied near its fundus, which at the same time closes the aspiration puncture.

"The patient is then placed in the proper position by raising the movable piece of the table for about six inches; gauze packings are laid over the neighboring viscera, and the parts are exposed with the help of blunt

retractors. Traction upon the gall-bladder is continued, and an incision with scissors is made through its peritoneal covering at the fundus, about half an inch from its junction with the liver. One blade of the scissors is worked between the serous and fibrous coats of the viscus, and an incision parallel to its long axis is made first on its anterior and then on its posterior aspect. Usually some tough fibrous tissue has to be divided in order to free the fundus from the edge of the liver; then the viscus is further freed with the finger, taking care not to lacerate hepatic tissue. Hemorrhage is usually very slight and is easily controlled by packing. Near the cystic duct the connection between the gall-bladder and the liver again becomes more intimate, and it may be necessary to divide fibrous tissue with the scissors, controlling an occasional little spurter with artery clamps. During this entire procedure traction is made by means of the ovarian clamp. When the cystic duct is reached, it is caught with a clamp, the jaws of which are at a right angle with the handles. Now with a hæmostatic needle a traction suture of silk or chromicized catgut is passed directly through the cystic duct about one-quarter or one-third of an inch beyond the clamp (*i.e.* between the clamp and the common duct). The ends of this suture are tied together, but the suture itself is left free, so that if desired it may be withdrawn after the operation. In order to be prepared for possible accidents, I usually put in two of these sutures. The gall-bladder is now ablated between the clamp and the traction sutures, after protecting any visible viscera with gauze. An assistant now makes traction by means of the sutures, raising the cystic duct toward the ex-

ternal wound. If the cystic duct is patent, bile will probably flow and the cystic artery or arteries will spurt. If there is no bleeding, traction on the sutures should be released until the vessel spurts. It is then caught and ligated. This done, the rest of the operation may proceed at leisure.

"The cystic duct being now freed from its fibrous connection with the liver, traction upon the sutures will bring the common and hepatic ducts into view, and if the cystic is patent, a large probe may easily be passed under guidance of the eye in either direction. If the cystic is not patent, it is not wise to trust to palpation in determining the presence or absence of calculi in the other ducts, but the cystic should be slit with scissors down even into the common duct, if necessary, or until there is a free flow of bile. In the absence of stones, a large-headed probe may now be passed into the duodenum. Large stones in the common duct may be removed through a prolongation of this slit, and stones from the hepatic may be brought to the opening by manipulation, or may even be removed through a separate incision into the hepatic duct."

Speaking of cholecystectomy, W. J. Mayo, writing in 1903,[1] says when it is indicated for cases of stone impacted in the cystic duct: "The duct and cystic vessels are caught with curved forceps just beneath the impacted stone and tied. These sutures are then cut across and the gall-bladder and duct with the stone removed from below upward, almost by traction alone, with an occasional division of some more firm adhesion to the liver." And again: "Should the walls of the gall-

[1] *Journal of American Medical Association*, Dec. 26, 1903.

bladder have undergone marked changes, or angulation and stricture of the cystic duct resulting in mucus fistula seem a possible outcome, cholecystectomy is more certain to afford permanent relief. If the cystic duct is completely obstructed so that the walls of the gall-bladder contain no bile, it is a simple operation to detach the organ from the liver and ligate with catgut at the base; but if the gall-bladder participates in the biliary circulation, in spite of the obstruction, it is not always wise to ligate the cystic duct, especially if there is a cholangitis present." [1] Under such circumstances, to facilitate drainage, Mayo has devised his well-known procedure of removing the fundus and enucleating the lining membrane of the gall-bladder, leaving the outer layer with the serosa as a shell or pouch into which the drainage tube may be fastened securely.

Removal of the damaged gall-bladder and cystic duct carries out the second of our cardinal rules; but when we come to the question of operation upon the other passages, — upon the hepatic and common ducts, — we find obviously that removal of damaged tissue is rarely possible, though removal of gall-stones is essential and inevitable.

Up to a few years ago most surgeons felt that the operation of *choledochotomy* should be performed with the greatest caution and the least possible disturbance to structure. Even the crushing and needling of gall-stones in the ducts, without opening the lumen, was advised and practised. Halsted of Baltimore designed an ingenious little instrument, known as "Halsted's hammer," which could be slipped into the duct, when

[1] W. J. Mayo, in *Boston Medical and Surgical Journal*, May 21, 1903.

that passage was open, and over it the duct could easily be sutured, as a seamstress darns a stocking-toe over a ball. In other words, the ducts, when opened at all, were opened fearfully and were reclosed immediately. We have now learned that suture of the ducts is not essential to their restoration of function. When slit up they heal as readily as does the urethra after the operation of perineal urethrotomy. It is our custom nowadays to open the ducts fearlessly when that is necessary for the removal of stones, and to drain them, usually without suture, when such drainage readily can be applied.

It was an appreciation of the practicability of such drainage that led to the adoption of so-called hepatic drainage, — commonly associated with the name of Kehr, though Richardson employed it as long ago as 1888, and other surgeons frequently have adopted the same measure. The object of hepatic drainage is to withdraw all bile at once to the surface, leaving dry the common duct so far as possible, and to encourage the expulsion by drainage of stones possibly lodged in the hepatic duct or its radicals.

Various duct-incisions for hepatic drainage have been employed; but as long as the opening in the duct is large enough comfortably to admit the drainage tube, the results are almost uniformly satisfactory, no matter where the duct be opened. Kehr incises the common duct and pushes his tube up two inches into the hepatic duct. Other surgeons slit up the cystic and common ducts and through this large orifice insert a tube, which, in either case, should be lightly stitched in with catgut.

This drainage of the ducts serves to carry off infec-

tious material. That is its great object. Cholangitis, in varying grades, practically is always present, especially if there be stones in the ducts; and drainage in such infected cases is as essential as is drainage for pleural empyema.

Seeking for stones in the ducts is sometimes a difficult matter; but the improved technique of recent years has rendered finding them more certain than formerly. Straightening out the passages, as described by Lilienthal, is a great help. Kuhn [1] describes at length his method of injection, which he claims will always discover stones in the common ducts. He fastens a nozzle into the gall-bladder or cystic duct and forces water in by hydrostatic pressure. Provided the ducts are clear, the water will disappear, not immediately, but in a short time, thus showing that its flow is taking place into the bowel. If, however, water returns and keeps returning in spite of increased pressure, an obstruction is indicated. Kuhn's method has not been generally adopted, for the reason that palpation and probing usually will settle the question of obstruction and will determine the exact location of the stone.

So long as stones are in the first portion of the common duct, their detection and removal are not difficult, — be it borne in mind always that a considerable dilatation of the duct is commonly present in cases of chronic obstruction, so that often the passage may be explored with the finger. When the stone or stones are lodged in that portion of the duct behind the duodenum or in the ampulla, a more difficult problem is presented to the surgeon. Two well-recognized methods for exploring

[1] Franz Kuhn, Berlin, *Therapeutische Monatshefte*, April, 1903.

this concealed region are in use, — the trans-duodenal route and the retro-duodenal route. McBurney, in 1891, was the first surgeon to employ the trans-duodenal route. His procedure consists in opening the duodenum from the front, finding the ampulla, and removing the stone through the duodenum itself. This method is effective and usually successful. It has the disadvantage of involving the interior of the gut in the field of operation, and adding, consequently, to the risk of sepsis.

C. M. Cooper, in a short letter published in the *Annals of Surgery* for September, 1903, gave what he believed to be an original method of reaching the post-duodenal portion of the duct by means of reflecting the duodenum and not opening it. In the same volume, however,[1] A. A. Berg had already described, with excellent plates, the same operation. This retro-duodenal method of Berg and Cooper consists in incising the peritoneum to the right of the duodenum, in reflecting that viscus, and so following down the common duct directly to its termination in the intestine. The writers believe that the latter method is to be preferred. After removing the stone it is well to suture the duct, leaving gauze drainage behind the duodenum.

From what has been said, it must be apparent that the removal of all stones, when possible, is imperative. Stones in the gall-bladder and cystic duct may be reached readily and always. Stones in the hepatic duct may be encouraged to escape through long-continued and effective hepatic drainage. Stones in the common duct and ampulla may usually be removed at a primary operation, the patient's strength permitting. However,

[1] *Annals of Surgery*, August, 1903.

sometimes, owing to the patient's weakness, or to extensive adhesions, or to the presence of malignant disease, deep dissection of the common duct may be impossible. Efficient and permanent biliary drainage is demanded, however, even in such cases, and for this the operations of

Cholecystenterostomy and *Choledochenterostomy* were devised. The nature of these operations has been explained already. The efficient and practicable method of doing them is by the use of the Murphy button, — the duodenum or, in exceptional cases, the colon itself being drawn up and made to anastomose with the gall-bladder or with the common duct.

Disease of the bile passages is frequently associated with pancreatic and with pyloric and duodenal disease, as has been stated already, and the nature of such association we describe in this book. Suffice it here to say that cases of chronic pancreatitis due to duct obstruction often are treated successfully by drainage of the bile passages, while pyloric disease — ulceration and stenosis associated with adhesions to the gall-bladder and ducts — is remedied by the breaking up of adhesions and appropriate supplementary operations on the stomach, Finney's operation or gastro-enterostomy.

Tumors of the bile passages are removable or are to be treated palliatively. As a rule those tumors only may be removed which involve the gall-bladder alone; rarely has it been found possible to remove tumors, and especially malignant tumors, of the bile-ducts. As we have stated, permanent obstruction of the ducts may be relieved by cholecystenterostomy, — when the obstruction is *malignant*, anastomosis between the gall-bladder

and transverse colon is indicated; in non-malignant diseases the anastomosis should be made, if possible, between the gall-bladder and the duodenum.

Richardson, in an article already quoted,[1] urges the propriety of removing gall-stones whenever discovered in the course of abdominal operations undertaken for lesions other than those of the bile passages. We believe his argument to be cogent and final; for, as we have frequently pointed out, gall-stones, even though quiescent, may at any time give rise to trouble; and their removal through cholecystostomy, with a small stab wound and drainage, does not add materially to the risks of an abdominal section.

From the foregoing paragraphs it must be apparent that we deem drainage of the deep field an essential in all operations on the bile passages. We have pointed out that an infection always is present, even when symptoms are quiescent; infection demands drainage. We do not recognize as proper the manœuvre sometimes undertaken, of removing by cholecystectomy an apparently innocuous gall-bladder full of stones, discovered in the course of some other operation, unless at the same time drainage be established. Such a cholecystectomy without drainage occasionally has been done, and the abdominal wound has been closed tightly without resulting damage; but we regard this result as a piece of undeserved good fortune to the surgeon, for every operator of experience knows that a ligature on the cystic duct does not always hold, and that leakage sometimes occurs with a resulting general infection of the peritoneum. If the surgeon removes the gall-bladder, he must drain the stump.

[1] *Journal of the American Medical Association*, Sept. 3, 1904.

We hope that enough has now been said to demonstrate without cavil the soundness of the three cardinal rules with which we began this chapter: —

1. Remove stones; for if left behind they are very sure to cause subsequent disturbance, and we know, conversely, that after the thorough removal of stones their recurrence is almost unknown.

2. Remove, so far as possible, all disorganized, degenerated, and permanently crippled tissue; for we have seen how such tissue, when left behind, may become a nidus for subsequent inflammation, stone formation, and a return to the invalid condition.

3. Drain; for without drainage we have no certainty of the removal of infectious material.

CHAPTER X

THE PANCREAS

To one reading the literature of diseases of the pancreas the striking thought is that most of our knowledge of these diseases is accidental. What we know has come from the study of cases upon which the clinician and surgeon have happened, and they have been able to explain them only by the autopsies that have followed, or they have explained them partially from the findings at operation, — findings combined with hypotheses formulated later. All this is true of many of our advances in the realm of the known; but it is perhaps more evident with pancreas disease than with any other subject in the domain of medicine.

More careful autopsies and more carefully observed clinical analyses, since the way was pointed out by Fitz about fifteen years ago, have led to the knowledge that disease of the pancreas is more common than used to be thought. Still, it is acknowledged, even by those who pretend to great experience, that diseases of the pancreas are very difficult in the diagnosis. A reason is not far to seek. When all has been said and written, the pancreas is found rarely affected so as to appear the central, or causative, factor in the symptom-complex of an obscure case. And further, even when the pancreas does turn out to be the source of symptoms, these symptoms are so often obscured by other symptoms which

can be interpreted in terms of other organs, that a mistake or partial diagnosis is a usual result.

The position of the pancreas, with its head beneath the pylorus and tucked into the bend of the duodenum, its duct uniting occasionally with the bile-duct within the substance of the gland just before their entry into the duodenum, its tail in close relation to the spleen and left kidney, its body overlying the great vessels, — this position tends to refer symptoms, truly arising from itself, to other more prominent organs. On the other hand, diseased conditions of other organs, especially of the bile passages, give rise, as has already been described, to morbid changes in the pancreas, and the symptoms resulting from these changes are wont to be regarded as part of the symptoms of the disease known to exist elsewhere.

In spite of the relative infrequency of pancreas disease, the relief which has come from certain operative measures, taken largely by accident, makes it imperative that the clinician should appreciate the symptoms appearing in the course of disease of this organ.

Diseases of the pancreas are, (1) hemorrhage into the pancreas, — acute pancreatitis, usually of a hemorrhagic character and, if survived, frequently followed by abscess or gangrene; (2) an infective process advancing through the duct, due to the same causes as set up infection in the bile passages; (3) a chronic interstitial pancreatitis, probably of two varieties, one involving the lobules, and the other the acini of the gland, showing itself especially about the islands of Langerhans, — these interstitial forms are due to long-standing local inflammatory conditions in the ducts, as well as

to the general systemic conditions producing interstitial atrophy in other organs; (4) neoplasms of the pancreas, of various kinds, cancer being by far the most common and important; (5) tuberculosis; (6) tertiary syphilis; (7) calculi; and finally, (8) cystic tumors in or about the organ, all of which go under the generic name of pancreatic cysts.

So far the majority of these pancreas diseases have come under clinical observation during operations undertaken for other conditions, or during the course of exploratory laparotomies. As the diagnosis is so difficult, it is necessary for the surgeon to bear the pancreas in mind when he is doing his various investigating operations, else he may miss the cause of the trouble for which he is operating.

One of the signs which should put the surgeon on the track of the pancreas is the presence of fat necrosis. On opening the abdomen the finding of disseminated nodules of fat necrosis should at once make the operator feel that there has been a definite lesion of the pancreas. The necrosed fat nodules may be differentiated from tubercles and cancer nodules, in that they are raised above the surface of the omentum and other fat-producing portions of the abdomen. The white or yellow opaque color is clearly marked off from the translucent yellow of normal fat. The fat necrosis is always most extensive in the neighborhood of the pancreas. The disseminated foci may appear within twenty-four to forty-eight hours after the onset of symptoms.

Robson and Moynihan are inclined to doubt whether multiple fat necrosis is always associated with destruction of pancreatic tissue; nevertheless, the combi-

nation of fat necrosis with pancreas disease is so frequent as to demand instant inspection of the pancreas when the fat necrosis is present.

(1) Hemorrhage into the pancreas, or pancreatic apoplexy, is characterized by the sudden onset of pain, either diffused or localized between the xiphoid and the umbilicus, associated with collapse. The symptoms may suggest perforation of the stomach or duodenum from latent ulcer, for there may have been indefinite digestive disturbances for some time, to complete the mystification.

So one may be tempted to do an immediate exploratory operation, but if one leans at all toward the diagnosis of hemorrhage into the pancreas, it is well to wait. The condition usually is fatal, and to add an operation would surely turn the scale toward fatality; moreover, the hemorrhage is practically never so extensive as to demand operative interference for its control. Small hemorrhages may be survived, as has been demonstrated at autopsy. Moderate hemorrhages may induce secondary changes. The hemorrhagic infarct may become infected and an abscess form, or extensive gangrenous sloughing may take place. These secondary conditions may lead to destruction of neighboring organs, or to death in a few days from septic absorption. Cases are on record in which the abscess discharged into the stomach or bowel, so that, if the observation was correct, nearly the whole of the necrotic pancreas was passed by rectum, yet recovery took place. Operations have succeeded for those secondary conditions, in which abscess or necrotic foci have been found and drained. Such operations are legitimate.

When successful, they are among the most brilliant of surgical procedures.

(2) Another form of acute pancreatitis is found usually associated with the presence of gall-stones in the bile passages, and follows the inflammation set up by their passage through the common duct. Opie has advanced the interesting and ingenious hypothesis that violent pancreatic inflammation is due to the backward flowing of bile into the duct of Wirsung. This flow of bile into the pancreatic duct is brought about, he thinks, by the lodgement of a small stone in the ampulla of Vater, just behind the papilla of the common duct as it enters the duodenum. The stone must not be large enough to occlude the pancreatic duct, since a simple damming back of the pancreatic secretion will not produce an acute inflammatory process. It is the presence of bile that causes the disturbance. Opie supports this hypothesis by the results of animal experimentation. Surgeons, however, have found similar pancreatic conditions when no gall-stones have been present, as well as when large gall-stones have been found in the common duct. On the whole, one may conclude that Opie's is but one of a number of methods of inducing violent inflammations in the pancreas, — inflammations leading to results similar in character to those produced by hemorrhages.

The most important lesson, however, to be drawn from this variety of acute pancreatitis and its sequelæ is a realization of the menace to health and even to life which gall-stones must always present. All the writers and collectors of cases agree that inflammatory disease of the pancreas is frequently associated with gall-stones.

(3) Chronic interstitial pancreatitis, from the operative point of view, presents a brilliant series of happy blunders. The cases have been diagnosticated after the event, but the favorable results are not yet fully understood. Indefinite symptoms pointing mainly to bile-duct disease have led to operative measures. Frequently no gall-stones have been discovered, but the head of the pancreas has been found enlarged and infiltrated, so as to constrict, or partially constrict, the common duct as it passes through the pancreas. Jaundice has been a frequent symptom, and the gall-bladder has been found enlarged at times and at times contracted. In emaciated subjects a tumor has been felt which has been found to be the head of the pancreas. The tumor, in a number of instances, has been regarded as malignant, and being left, only the recovery of the patient has led to a change in the diagnosis. The operation has consisted simply of draining the gall-bladder or occasionally doing an anastomosis between the gall-bladder and the duodenum. Sometimes this anastomosis has been done at a secondary operation. The results, in a number of cases, have been brilliant; the jaundice has cleared up, and after a number of days inflammation has subsided, so that in the case of cholecystostomy, bile has again appeared in the stools. Finally, the fistula has closed and recovery has persisted.

In unfortunate cases, when death has occurred, extensive inflammatory exudate has been found in the pancreas, with the formation of connective tissue. This form of chronic interstitial pancreatitis is of the interlobular variety, and is rarely associated with diabetes.

Just what takes place through drainage of the gall-

bladder is hard to say, especially as in one case, reported by Robson and Moynihan, the gall-bladder was not drained, and absolutely nothing was done beyond the exploratory operation. Even in this case, within a couple of weeks, the jaundice had gone; and at the end of three weeks this moribund patient went home, — the tumor had disappeared, and she was well once more. Certainly this case, taken in conjunction with those in which drainage has been instituted, makes it seem possible that drainage alone may not deserve the credit for certain cures.

(4) Malignant disease may occur either primarily or secondarily in the pancreas, and may cause obstruction of the ducts passing through the gland's substance. When found in the course of an exploratory laparotomy, a malignant tumor is best left alone. Employ only such proceedings as may relieve the patient, — drainage of the gall-bladder, or gastro-enterostomy if the lumen of the duodenum is in danger of being occluded. Cases supposed to be malignant have been proved to be inflammatory through the recovery of the patient.

(5) Tuberculosis and

(6) Tertiary syphilis do not concern this discussion.

(7) Pancreatic lithiasis is seen, but it is by no means as common as stone formation in the bile-ducts. Its diagnosis practically is impossible except from finding stones in the fæces. The pain of pancreatic lithiasis is described as colicky in character, and is said to be less severe than that of gall-stones; but as all degrees of severity are present in biliary calculi, the distinction is not obvious. Tenderness, if present, is located over the pancreas. Diabetes is wont to be associated with

pancreatic calculi rather than with biliary calculi, and in pancreatic lithiasis there may be a fatty diarrhœa. It is rare that we can group together before operation symptoms enough to make a clear diagnosis of pancreatic calculi. For the most part, reporters of cases mention the presence of multiple calculi, and even a diffuse paste or calcareous scales, as well as well-developed stones, throughout the length of the duct of Wirsung. The outlook for cure by operation, even with a positive diagnosis of calculi, is not very encouraging.

(8) The form of pancreatic disease which most legitimately belongs to the domain of surgery is the pancreatic cyst. Under the term "cyst" are grouped several different pathological processes. Frequently, in fact, the so-called pancreatic cyst is entirely outside of the body of the pancreas.

The form of pancreatic cyst typical in its development, and most easy of diagnosis, may be seen as a tumor, which has appeared after a blow in the pit of the stomach, or after an accident in which the patient has been caught and crushed between two solid objects, — the greater part of the pressure coming across the upper part of his abdomen. This accident, should it result in injury to the pancreas, is often followed by the development of a tumor in a few hours or after several days. Such a tumor is located usually in the median line above the umbilicus. For the most part it develops rapidly and becomes tense and fluctuant. Such a tumor, a pseudo-cyst of the pancreas, is due to the extravasation of blood and secretion about the pancreas itself, or to sealing of the foramen of Winslow with inflammatory exudate, and the development of a cyst within the lesser

cavity of the omentum. Wherever the cyst be, the crushed pancreas is liable to furnish to it a certain amount of pancreatic fluid, as can be demonstrated by appropriate tests. Hence the name "pancreatic cyst" is applied to these extra-glandular tumors.

Besides these traumatic cysts, pure retention cysts are found in the gland. They are usually small and slow in development, and may not give rise to symptoms. In a few reported instances they have become large enough to be mistaken for immense ovarian tumors, so completely have they filled the abdomen. At times their origin is shrouded in mystery, even on the autopsy table. Pancreatic calculi, cicatrices, pressure from without, are causes of such cyst formations.

Proliferation cysts are adenomatous or epitheliomatous. Hydatid cysts rarely may be found in the pancreas as well as in the other abdominal organs. Finally, in children, there may be congenital cysts of the pancreas, as there may be cystic disease of the kidneys.

Such are the diseases which occur in the pancreas. Their enumeration emphasizes the statement made in the early part of this chapter, that, owing to the position of the pancreas, other organs are wont to be involved with it, and to furnish the more prominent symptoms, even when the disease is primary in the pancreas. Further, it must be repeated that pathological conditions arising in other organs often obscure secondary, but important, changes in the pancreas.

What are the *symptoms* associated with extensive disease of the pancreas? The list is a slight modification of that presented in great detail by Robson in his

Hunterian Lectures. Under disorders of digestion are to be considered: —

(*a*) Steatorrhœa, or fatty stools; and one should remember that the fat may be free, or appear as fat- or soap-crystals. The latter may appear also in jaundice unassociated with pancreatic disease.

(*b*) Azotorrhœa, due to imperfect digestion of proteid material, particularly of meat. This is a condition that has to be sought for; it does not force itself upon one. Soft, bulky stools containing both fat and undigested muscle fibres are very suggestive of a pancreatic complication.

(*c*) Siatorrhœa, or excessive pancreatic secretion, is a symptom mentioned by Senn; but it is of no practical importance.

(*d*) Diarrhœa, — this is not a watery affair, but characterized by frequent, large, soft, greasy stools.

(*e*) Dyspeptic symptoms with anorexia; the patient has a great distaste for food, especially the fatty foods, and he has more or less discomfort, heaviness after eating, as well as heartburn; sometimes he has nausea and vomiting, both of which are apt to be present in the more acute attacks.

The physical signs are:—

(*a*) Great emaciation, as the result of interference with nutrition.

(*b*) A tumor; and Robson has found this much more frequently than the text-books have stated it to be.

(*c*) Fever, which is not a prominent sign; in the cases of malignant disease a subnormal temperature is not unusual.

(*d*) Tenderness, and accompanying muscular spasm

— variable. At times the location of the pain is definite; at other times, even with extensive lesions, there is no pain or tenderness; the pain may be diffuse.

(*e*) Evidence of pressure is manifested by the condition of other organs. Of special note is the presence of ascites from pressure on the portal vein; and jaundice, which is to be expected from the involvement of the common duct in the head of the pancreas.

(*f*) Hemorrhage, when it exists, is not shown by blood in the stools. We may observe the general symptoms of internal hemorrhage. It is not to be forgotten that a hemorrhagic diathesis, so to speak, may be developed in those suffering from pancreatic disease. The administration of calcic chloride as a means of averting hemorrhage is recommended before any operation upon the pancreas.

Metabolic changes are shown by the presence of (*a*) glycosuria, — this symptom is too inconstant for diagnostic purposes (when it appears, while the patient is under observation, it is an unfavorable sign, coming as it does when the destruction of pancreatic tissue is very far advanced; hence, its appearance is practically a *contraindication* for operation); (*b*) the "pancreatic reaction" in the urine. Robson believes this the great enlightener in making the diagnosis of pancreatic disease. We shall describe it at length later on.

Special tests: —

1. The production of alimentary glycosuria — demonstrating the insufficiency of pancreatic juice to take care of an excess of ingested sugar. To ascertain this, two or three ounces of sugar are given to the patient before breakfast. The early morning urine is saved and

tested as a control, and then the urine is tested for sugar every two hours after breakfast. Sugar usually will be found, if at all, in the first specimen of urine.

2. Sahli's test: When a gelatine capsule, hardened in formalin and filled with iodoform or salol, is administered, it will pass the stomach without being dissolved, but will be dissolved in the pancreatic juice if that is present; thus, in from four to eight hours an examination of the urine will show the presence of the drug, if pancreatic juice is being secreted. In the absence of pancreatic juice, the drug will not appear in the urine.

3. There is the so-called "pancreatic reaction." Robson states that, beginning with crude attempts, P. J. Cammidge has been able to develop a characteristic urinary test, by which one may ascertain whether or not disease of the pancreas is present, and whether or not the disease is inflammatory or malignant. Cammidge doubtless knows the difficulties in the way of accuracy better than does Robson, and he is decidedly less enthusiastic in his statements. The procedure is complicated and takes time to carry out; nevertheless, it is well to remember that the pancreatic reaction obtained from the urine is regarded as the greatest help by one who has had a broad experience in dealing with pancreatic disease.

A description of the pancreatic reaction is given by Cammidge, in his Arris and Gale Lecture, 1904. The collected urine, free of all sugar and albumen, is first filtered, and 10 c.c. taken, to which is added 1 c.c. of hydrochloric acid. This mixture, in a small flask, in the stopper of which a glass funnel is inserted, is boiled for ten minutes over a sand bath. To this 5 c.c.

more of filtered urine and 5 c.c. of water are added, and the flask containing the mixture is then cooled in running water. Four grammes of lead carbonate are added to neutralize the mixture, which is then filtered. To the filtrate 2 g. of powdered sodic acetate and .75 g. of phenylhydrazin hydrochlorate are added, and the whole is boiled for three or four minutes. The mixture is set aside and allowed to stand in a cool place. Within twenty-four hours a flocculent yellow deposit is found at the bottom of the tube. This deposit is picked up with a pipette and examined with a one-sixth objective, when, if the reaction is successful, the precipitate will be found to be made up of yellow crystals in the forms of sheaves and rosettes. The positive test does not indicate pancreatic conditions alone, as pneumonia, "adenitis," and cancer, located elsewhere than in the pancreas, will give the reaction. If the urine is first treated with perchloride of mercury, the test is negatived, except in the case of cancer of the pancreas, when crystals will persist.

In the course of the Cammidge test, it will be found that the crystals in cases of cancer are larger and broader than are those of inflammatory origin, while the crystals of chronic inflammation are larger than the very fine crystals of acute inflammation. Further verification of all this is wanted, however, and will be found by letting a drop or two of a 33 per cent sulphuric acid solution run under the cover glass while the crystals are being observed. Then the yellow crystals turn brown and dissolve. The crystals from acute pancreatitis dissolve rapidly, — in from a few seconds to three-quarters of a minute; those from chronic pancreatitis

take longer, — one to two minutes; while the crystals from cancer take three to five minutes to dissolve.

To summarize: If, as a result of the reactions, crystals are formed, pancreatic disease is to be deemed present (pneumonia and cancer elsewhere being absent). If the crystals are present when the reaction is first done, but are not found if the urine is previously treated with mercuric perchloride, and if the crystals dissolve rapidly in sulphuric acid, acute pancreatitis is present. If, however, the crystals take from one to two minutes in going into solution, we are dealing with a chronic inflammation. If crystals are found both when the urine has been treated with the perchloride of mercury and also when it has not been so treated, and if the crystals take three to five minutes to dissolve, the disease under consideration is *cancer*.

If these conclusions are as important and sure as Robson and Cammidge apparently think them to be, it is to be hoped that the process will be simplified so that it may be employed by the everyday practitioner.

Treatment. — The pancreas, the liver and ducts, and the stomach hang like three apples on a single stem, — the duodenum. Whatever affects one often affects the others. All are organs of digestion, but of them all the pancreas physiologically is by far the most important for purposes of digestion. One can live without a stomach, one can even live without the bile of the liver, but we have reason to believe that one cannot live long without the pancreas. So it is by a shrewd provision of nature that the pancreas is so placed and guarded as infrequently to be the subject of disease or injury. And it is a delicate organ, structurally, — easily damaged by

violence, whenever violence may reach it; gravely infected when infective agents penetrate its depths; and when diseased, a potent menace to health and to life.

So we have seen, in this brief study of its derangements, that traumatism is the commonest cause of its cysts; that mechanical irritation, through cholelithiasis, is the important cause of its chronic inflammations; and that chemically irritating bile or infecting organisms from a diseased stomach or intestine are the causes of its acute diseases.

Bearing etiology in mind, then, let us make some study of treatment; and we know from our study of the pathology that all active treatment of these troubles must be surgical. Sometimes the Carlsbad regimen, prescribed for disease of the bile passages, may chance to relieve an unexpected pancreatic complication; but this is hypothesis.

Broadly speaking, there are three types of pancreatic disease for which we operate: —

Cysts, in which the results of operation are good.

Acute inflammations, in which the results are bad.

Chronic inflammations, in which the results are good.

There are also tumors and adhesions, but as yet surgery concerns itself little with them.

Cysts of the pancreas are either intra-glandular or extra-glandular. The former are small affairs usually, but they may grow large, as has been said, and clinically they cannot be distinguished from the extra-glandular cysts. The symptoms of the two are similar, — gradually increasing pain, after considerable size has been reached, then vomiting, malnutrition, rapid wasting.

One cannot make the diagnosis until he can feel the tumor. Often the mass protrudes between the stomach and colon. One notes the two areas of visceral tympany, with the tumor dulness between them. Rarely the cyst may bulge elsewhere.

There are two methods of operating (for we discard absolutely the old aspiration), drainage and enucleation.

Drainage is a very simple matter, and cures the patient. Open through the rectus muscle, tear through the mesocolon, draw up the cyst, and stitch it to the abdominal wound. The cyst may be opened at once, — the commonly practised method; or one may wait three days for adhesions to form, and then open it. In either case, employ tube drainage. Before bringing the cyst forward, if its wall is tense, it may be well to relieve the internal pressure by aspiration. If the permanent opening is made at once, use care, by gauze packing, to prevent soiling and irritation of the peritoneum.

When drainage has been established, cover the neighboring skin with zinc ointment to protect it from the acrid discharges. Employ a voluminous dressing.

The cure is not prompt in these drainage operations. A fistula will persist for months or even a year or more, but eventually it will close.

In ten days the patient may be sitting up, and may be out in the third week.

These operations for cysts, therefore, are safe and easy. Böckel's figures, published in 1901, are as good as ever. Out of ninety-nine persons operated upon by immediate opening and drainage, ninety-two recovered, — a mortality of 7 per cent. Of sixteen operated upon in two sittings, all recovered.

Enucleation or extirpation of the cyst is an ideal operation, if it can be done, for the wound closes promptly and convalescence is short; but enucleation is possible in exceptional cases only. Usually enucleation is a bloody and difficult procedure. If there are extensive adhesions and a broad pedicle, the surgeon had best not attempt it. If there are but slight adhesions and the pedicle is narrow, the operation is feasible; but such conditions are rare. Twenty-five cases of enucleation are recorded, with four deaths. In any case drainage must be employed to provide for hemorrhage.

Cases of pancreatic cyst come properly into the category of digestive disorders, for in the end they do cause digestive symptoms of a marked type, and their removal effects brilliant cures.

Acute inflammations of the pancreas present us with a different problem, — a discouraging problem. The condition is lethal, the outlook bad, no matter what we do. We have already dealt with the question of operating immediately in the case of pancreatic apoplexy. In such case, with the patient in profound shock, we cannot advise immediate operation. We must wait. Sometimes the symptoms may subside, sometimes an acute inflammatory process may have begun, which, if left alone, may run on into a subacute form.

We are not in accord with those who recommend long delay. If, after the immediate shock, the infection is not subsiding, we believe in drainage to evacuate septic material. The operation then adds little to the already urgent risk.

A small anterior incision, under local anæsthesia, if thought best, at once will settle the question of a spread-

ing infection. If such an infection is present, drainage may be instituted.

On the other hand, if we find that the general cavity of the peritoneum is not involved, posterior exploration and drainage may be employed. This is done by opening the back through a large incision at the left costovertebral angle. The operation is not difficult. The pancreas thus may be explored and drained extra-peritoneally.

It is hard to see how one is to differentiate clinically such conditions from an acute pancreatitis due to septic invasions from without the organ.

Fitz says, "Acute pancreatitis is to be suspected when a previously healthy person or sufferer from occasional attacks of indigestion is suddenly seized with violent pain in the epigastrium, followed by vomiting and collapse, and in the course of twenty-four hours by a circumscribed epigastric swelling, tympanitic or resistant, with slight rise of temperature." That might apply to acute pancreatic disease, however induced. If, now, the acute process in the pancreas be inaugurated by the sudden inrush of septic material from without, the course of the disease is not so overwhelmingly bad as in the cases of pancreatic apoplexy. If the apoplexy is to kill, it does so in a few hours. The acute septic invasions take days rather than hours.

Whatever be the cause of these acute infections, surgeons have to deal immediately with a grave disaster, in which the peritoneum is involved. So one must open from the front and drain. Indeed, the procedure is precisely that described four paragraphs back. If there be established a widespread peritonitis, both renal

regions should be drained with tubes, as well as the pelvis. Gauze does not drain. In other words, one must treat the peritonitis as though its origin were in a perforated appendix or duodenum.

The attendant should not immediately afterward start up the bowels with cathartics. Cleansing enemata, nutrient enemata, normal saline solution by rectum, in the veins, or under the skin, strychnine, gastric lavage, nothing whatever by the mouth for forty-eight hours, — such must be the after-treatment.

If the acute case is not attacked at once, but is allowed to run into a subacute condition (indefinite term), extensive damage to the pancreas and to the surrounding tissue may result, with death as the finale. The pancreas will show suppuration and gangrene at the post mortem.

Even if the patient be saved by operation, and if some degree of health be restored, there is always the underlying cause of the acute attack to be considered. That underlying cause may be disease of the stomach, the duodenum, or the bile passages, — all of which must be investigated by the diagnostician; and if there be disease of these organs, it must be treated if one would avoid chronic invalidism. When all is said, the operation in acute pancreatitis is followed by a high mortality. We find thirty-two cases operated upon, with seventeen deaths. From the nature of the disease we cannot look for a death-rate much below 50 per cent.

Chronic pancreatitis, especially the interlobular variety, is by far the most interesting form of pancreatic disease just now presented to the surgeon. We have

already referred to the mysterious cures with which the surgery of this disease is credited. The disease is often a digestive disorder of the first magnitude, in the sense that it is associated with faulty digestion, poor metabolism, pain, wasting. One will see it associated also with jaundice, and often one will find it impossible to distinguish from disease of the bile passages. The reason for that confusion is obvious and inevitable: chronic pancreatitis frequently is associated with and dependent upon disease of the bile passages. Duodenal ulcer is another not uncommon cause or complication of pancreatitis.

As we know, chronic pancreatitis may be due to partial or complete obstruction of the duct of Wirsung. A calculus in the lower portion of the common bile-duct, when that duct lies against the duct of Wirsung, may press upon the latter and cause obstruction and a backing up of the pancreatic secretions. Or the ampulla of Vater may be completely filled by a calculus, which thus dams back both bile and pancreatic juice. In either case there ensues a chronic pancreatitis associated with the biliary symptoms we have described.

Wherever the stones, therefore, an operation for the removal of gall-stones, if at the same time we drain the passages, will often cure the pancreatitis. Often, too, even when the stone is overlooked, drainage of the bile passages will relieve pressure and congestion, relax the lumina of the ducts, and by allowing the calculus to escape either up or down, bring about a return to the normal. This is, therefore, an excellent reason, if no other reason existed, for providing drainage in every case of diseased bile passages associated with jaundice.

There is that other class of cases of chronic pancreatitis, however, already mentioned, — a mysterious class, in which the bile passages are free. Even in such cases operation with drainage has cured at times. It seems probable that in certain of these cases there is present a mild grade of infection, — in the duodenum, perhaps associated with ulcer, in the bile passages, and in the duct of Wirsung. The ampulla may be more or less occluded by inflammatory swelling. In such conditions cholecystostomy is indicated obviously, and the drainage thus established should be expected to promote the reparative process.

That case of Robson and Moynihan in which a simple exploration without drainage was followed by a cure cannot be explained on any such grounds. Indeed, we cannot believe that the operation had any bearing on the result. It is reasonable to suppose, however, that in some way a relief of obstruction took place coincidently with the operation, enabling the writers to chronicle a happy result.

Of course, there are many cases which biliary drainage does not cure. In the presence of advanced interstitial changes, with contraction or obliteration of ducts, drainage will not avail; but one cannot be sure of the conditions until he has tried drainage. Our rule in these chronic cases, therefore, must be to establish drainage by cholecystostomy. Three or four weeks later, if it has become evident that the pancreatitis will not thus be relieved, the surgeon may decide to let the patient go on with a permanent biliary fistula, or he may do a secondary cholecystenterostomy. We know the mortality from the latter operation to be high. Rarely,

in consequence of an enormously distended gall-bladder overlying the stomach, a cholecystogastrostomy has been done, and without ill effects from the bile outpoured into the stomach.

As for tumors of the pancreas and calculi of the duct, much of what we have already written will apply to them. If the tumor, usually situated in the head of the organ, is malignant, nothing beyond drainage for palliation can be done. But often one cannot distinguish a cancer from pancreatitis. If drainage be instituted, the tumor may disappear, thus establishing the diagnosis of non-malignant disease.

As for calculi, one cannot always recognize them, even at operation. They are rare. Sometimes they are discharged by the bowel. Sometimes biliary drainage frees them and allows of their exit. At all events, when present, they form an integral part of the inflammatory process.

Such, in outline, is the surgical problem of chronic pancreatitis; and the experience of the last few years justifies us in feeling that in a considerable number of obscure obstinate "dyspepsias," resisting treatment, when the source of the trouble is to be sought somewhere in the upper region of the abdomen, then the pancreas, alone or with its associated organs, often will be found at fault.

CHAPTER XI

ABDOMINAL PTOSIS

Abdominal ptosis is a subject of great importance. We shall not attempt a discussion of all its phases, but briefly we shall point out what clinicians may do to relieve the symptoms and the condition ptosis of itself. Incidentally, too, we must say a word on the general subject of the etiology of ptosis, as there is a good deal of misunderstanding of that matter, so various are the views of sundry writers.

Virchow long ago recognized visceral ptosis; and movable kidneys have been observed for many years. In 1881 Landau wrote a monograph calling attention to the importance of the movable kidney in women. Glénard, however, in 1885, was the first to show clearly and distinctly that by ptosis of the abdominal organs one may explain on anatomical grounds a group of clinical symptoms hitherto regarded as purely functional. Glénard maintained that sufferers from these functional disorders were cured of their dyspepsias and backaches and neurasthenias through relief to the ptoses found in their cases. He gave the name "enteroptosis" to the most common assemblage of derangements which he was accustomed to find; namely, to ptosis of the intestines and stomach combined with a prolapsed right kidney. This combination of lesions has been called Glénard's disease. The term "splanchnoptosis" is applied to pro-

lapse of all the abdominal viscera, — a very rare condition. Some German writers and others recently have used the term "splanchnoptosis" in place of the older and more common term. The displacement of single organs is designated by special words, "gastroptosis," "nephroptosis," "hepatoptosis," "splenoptosis," etc. Properly the term "enteroptosis" should be employed to describe prolapse of the intestines alone, but we shall follow the common usage as established by Glénard.

Briefly, ptosis of the abdominal organs is due to a relaxation of their supports, so that they sag from their places. The consequent dragging upon vessels and nerves brings about certain changes in the circulation and innervation of organs, especially of those organs in the female pelvis. So the uterus may be forced out of place, and further distressing symptoms may result. Moreover, ptosis of the intestines removes an important support from beneath the upper abdominal organs.

To distinguish cause and effect is difficult often, so closely are the various organs bound up together and dependent upon one another; and the clinician, according to his bias, is wont to regard a patient as a gastric, gynecological, intestinal, or nervous case.

The underlying causes of ptosis are still in dispute, so diversified are the conditions found and so great the range of symptoms accompanying them. In explanation of ptosis, Glénard suggested weakness of the abdominal muscles and a loss of intra-abdominal pressure or tone, which permits the stomach, intestines, and kidneys to sag. Some writers go further and suggest that the displacements are congenital; while others put the blame upon improper clothes, especially on corsets and

the bands of heavy skirts; writers point out, also, the disturbing effects of pregnancy. After considering these statements and studying many patients, we cannot but believe that all such explanations are plausible, but that rarely does any single explanation suffice.

The argument for a congenital origin of abdominal ptosis rests on the fact that the kidney in the embryo has a position similar to that of a displaced kidney in the adult. Late in embryonic life the kidney moves upward and disappears behind the ribs. The retention of the kidney in its early embryologic position is used to explain the displacements of the kidneys not unfrequently found in children and also in young women who have not worn constricting clothing or been pregnant.

Further, to advance the argument for congenital ptosis, it is generally acknowledged that persons with symptoms of nervous dyspepsia, with constipation and indefinite pains, conform to the type described by Glénard. These patients are thin, flat-chested, and long in the flank; their back muscles are weak and their shoulders are drawn far back, while their heads slouch and their abdomens protrude. Of this type are practically all the men with movable kidneys. Women of this type add to their deformity often by wearing badly made corsets and heavy skirts. Persons, too, who stand for long hours at their work, shop girls behind counters and motormen on electric cars, are wont by their occupation to aggravate an already vicious tendency. Most women among us wear their clothes without regard to hygienic considerations. They hang heavy skirts by narrow bands from their waists, so that a drag is brought upon the intestines which lie in the lower part

of the abdomen. The crowded intestines, in turn, press upon the pelvic organs beneath them. Corsets tend to accentuate the waist line; they crowd down what is below and push up what is above. Straight-front corsets do not push the abdominal contents downward as do the old-fashioned corsets, though even straight corsets may produce other unpleasant changes in the anatomy. Often and fortunately, however, straight-front corsets when properly applied may suffice to correct enteroptosis. In the course of physical examination of elderly women, it is not uncommon to find a permanent furrow made in the costal margin due to corset pressure. In view of these facts one cannot but conclude that bands, heavy skirts, and corsets must be etiological factors in ptosis. Finally, one encounters cases in women whose symptoms all date from a childbirth. Of such persons it is probable that many of the displacements were present previously, but did not become troublesome until after the labor. The onset of such symptoms may date from the birth of a first child, or may be due to a precipitate or difficult and instrumental delivery. In view of these facts we conclude, as has been said already, that there are many and various causes of abdominal ptosis. One could mention other causes, — trauma, falls, strains in lifting and reaching, over-exertion as from prolonged bicycle riding and even the persistent vomiting of seasickness; and so on for many paragraphs. So many are the possibilities in our list that the wonder is how any woman escapes having some of the physical signs of ptosis of the abdominal and pelvic organs; indeed and as a fact, a large number of women do furnish such signs.

Movable kidneys, pulsating aortas, protuberant bellies, uterine displacements, and prolapses are phenomena seen daily in our clinics. Truly it is usual to find some of the signs which are dependent on ptosis of the abdominal or pelvic organs, when making the examination of any mature woman.

It is striking, however, that in spite of this frequency of anatomical displacements, *symptoms* of ptosis are relatively rare.

Glénard errs, for no man who has served in a clinic for women would be willing to agree with him, when he implies that all palpable kidneys are pathological and cause symptoms. And yet most of us will admit that every displaced organ has the potentiality for causing symptoms that may demand prompt surgical treatment for their relief.

The misconceptions as to the frequency and seriousness of ptosis arise commonly from the fact that some physicians and most surgeons see the rare and severe cases only, while other physicians see for the most part the many painless cases.

What, then, is the process in the development of ptosis? One cannot say definitely that in this or in that begins the vicious circle causing prolapse of the abdominal organs, yet in general terms one may use some such description as the following: —

Owing to structural peculiarities, to flabby abdominal muscles weakened by severe illness, to improper clothing, or to pregnancies, the normal abdominal tension is diminished; the transverse colon is loosened, usually at the hepatic flexure, and sags downward; it crowds the coils of the small intestine so that they in turn press

upon the pelvic organs. With the loss of abdominal tone the whole colon then tends to collapse, and this collapse extends even to the rectum, so that there is no longer a dilated rectal ampulla behind and below the uterus. The muscles of the pelvic floor lose their resisting power, the uterus settles, and the coils of the small intestine are crowded still farther into the pelvis. There ensue modifications in the shape and position of the pelvic organs, and one finds a prolapsed, retroverted, and retrocessed uterus, and the various combinations familiar to gynecologists. The reader must not suppose that such superimposed pressure is the only cause of uterine displacements, but certainly it is a frequent cause.

The stomach follows the intestines, for it no longer receives their normal support. As the stomach sinks, the aorta is left uncovered for several inches above its point of division. It may be palpated and may even be seen to pulsate. Indeed, this pulsation is often disagreeable and annoying to the patient.

Note, now, that there is one complicating cause of intestinal prolapse, a cause which may be remedied by operation; we refer to a separation of the recti muscles consequent to pregnancy. In such case the patient frequently has the sensation that her intestines are falling out. Every motion causes abdominal straining and is frequently accompanied by a protrusion of the bowel between the muscles. The condition is that of a large ventral hernia. Cure the hernia by operation, and you will thus relieve greatly the ptosis.

Other operations have been practised for intestinal ptosis. Lambotte has attached the splenic and hepatic

flexures to the abdominal wall and thus restored the colon to its normal position, approximately. In his cases there had not been any great prolapse of the stomach; he operated to relieve severe and repeated attacks of intestinal colic. He was successful.

Sometimes the sigmoid flexure becomes dilated with retained fæces as a result of intestinal prolapse. The gut may expand greatly and in the course of time may develop a tendency to volvulus. Consequently intestinal obstruction may ensue; and unless this is relieved by high enemata and postural devices, there may supervene rapidly a strangulation demanding surgical relief. In such case the condition of the patient may permit a palliative operation only; the operator may untie the obstructing twist and possibly may hold it by sutures so that the volvulus will not return. When a patient suffers from repeated similar attacks, increasing in severity, operation must be done to anticipate strangulation. At the operation it may be necessary to resect a portion of the dilated bowel; for, often, resection alone promises a permanent cure. So, after palliative operations, one may be obliged to perform a secondary operation of resection.

So much for the operative treatment of intestinal prolapse. Let us now consider prolapse of the stomach, which follows the intestines in their fall. Its descent is favored, also, by the weight of its contained food, and by the pressure of corsets and bands tending to stretch the other supports which hold it in a more or less vertical position normally. Consequently the greater curvature of the stomach sinks gradually, and the organ approaches the horizontal. This new

position results in its dragging on the pylorus and the first portion of the duodenum in such a way that the passage of food into the intestine is impeded, and a certain amount of gastric motor insufficiency is induced. These conditions cause a further descent of the stomach, because motor insufficiency results in its being kept loaded longer than usual. Gas formation and stomach distention result, as well as a frequent tendency to hyperacidity with the attendant possibilities of ulcer formation. It is said that this last danger is especially to be feared when floating kidney is associated with the gastroptosis.

As the general ptosis progresses, the stomach descends into the abdominal cavity until its greater curvature is well below the umbilicus. What is more to the point, for diagnostic purposes, the upper border will then be down in the epigastric region below the costal margin.

What of diagnosis? What of the significance of symptoms? What of treatment? In thin persons the prolapsed stomach, after a full meal, often may be seen, while in the case of others one must distend the stomach in order to make it out. Ptosis of the stomach may exist without giving rise to any dyspeptic symptoms; indeed, ptosis does not necessarily imply dilatation. That a prolapsed stomach may be normal in size can be demonstrated by the examination of young and thin women. Moreover, moderate motor insufficiency may exist without associated dilatation. Frequently, in the case of a markedly prolapsed stomach, when dyspeptic symptoms are present, they may be relieved quickly by a proper diet, proper exercises, and massage. One smiles to remember a masseuse chagrined at having

pointed out to her the low-lying stomach of a patient, whose indigestion and constipation she had cured by manipulations. The masseuse should not have been chagrined; the patient's symptoms had been relieved, her general condition had been improved by the treatment; the prolapsed stomach could now perform its functions satisfactorily, and the patient would continue well, probably, until upset by some future physical or mental strain. One will find gastric dilatation added speedily to prolapse in those cases in which dyspeptic symptoms are not checked by proper treatment. The prolapsed stomach drags on the pylorus so that there results a permanent kinking and narrowing of the pylorus. These cases of ptosis, plus dilatation, must be studied carefully if one would recognize the presence of the two associated conditions, ptosis and dilatation. Evidence of stasis and an increase in the amount of hydrochloric acid are present, except occasionally in long-standing cases. The capacity of such a stomach is increased. Let the clinician note accurately the position of that viscus.

In the case of such a stomach there exists a genuine pyloric stenosis, a stenosis as baneful as that caused by a cicatrized ulcer. Some form of operation is needed for the cure, and the choice of operation should be governed by the rules laid down in a previous chapter.

Moreover, special operations have been devised for ptosis of the stomach. The gastrohepatic ligament, stretched by the descent of the stomach, has been shortened by Beyea and sundry other surgeons. They pass sutures so as to bring the pylorus close up to the under

surface of the liver. The first suture includes both the capsule of the liver and the outer coats of the stomach. Beyond this point the gastrohepatic ligament and the lesser omentum are infolded so as to raise the stomach and make its upper border resume the normal position. It is suggested that one should fasten up the colon at the same time, else will the stomach lack its old support beneath.

Various other suspending operations have been recommended and tried, — such as swinging up the stomach in an omental hammock, or attaching it to the abdominal wall; but no definite and final procedures have been perfected. Whatever one does, he risks introducing new bad symptoms for those he attempts to remedy. In our own experience, gastro-enterostomy, or the operation of Finney, have yielded good symptomatic results in gastroptosis. However, the subject is still in an experimental stage.

Of all the abdominal organs subject to ptosis, the kidney receives most attention — more attention, relatively, than it merits.

The reason for this undue attention is because kidney ptosis is readily discovered. The organ is single and distinct. Normally it cannot be palpated, because it is situated beneath the diaphragm ; but when prolapsed, it is easily grasped. So nephroptosis is made to explain many indefinite pains and backaches. Floating kidney may be recognized as readily almost as may the displaced uterus or ovary. Moreover, the floating kidney, a single, solid organ, manifestly out of place, offers a tempting mark for the enthusiastic operator, who shrinks from the difficult task of attempting to re-

place and secure other prolapsed viscera, even when those viscera are the more pernicious offenders.

The wisdom of routine operating for nephroptosis is in dispute. If one would reach firm ground in that dispute, one must appreciate and assure himself of the frequency of the condition, and one must realize the true significance of abdominal symptoms. Doubtless the kidney is displaced frequently. Glénard states that 23 per cent of the female bodies in the Anatomical Laboratory at Kiel in one year exhibited a downward displacement of the kidney; in the following year nephroptosis was found in 28 per cent of the bodies. This is interesting, because for a long time pathological anatomists failed to find movable kidneys, though movable kidneys were recognized by the clinicians daily. In a series of two hundred and seventy-two women recently examined clinically at the Boston City Hospital, Larrabee found that one hundred and twelve cases, or 41.5 per cent, had movable kidneys. At the Massachusetts General Hospital, in 1904, Pratt looked for ptosis in all cases coming to his clinic, and found that ninety-six, or 32 per cent, out of two hundred and seventy-one women were the subjects of movable kidney.[1] Such has been the experience of many others. Nephroptosis in men is more frequent than is commonly supposed. Floating kidneys have been found in children.

Frankly, we cannot unreservedly accept Keith's statement, that floating kidney is dependent on contraction of the diaphragm and a consequent narrowing of the infra-diaphragmatic space. It is significant, how-

[1] It is interesting that each of these observers, with the same number of patients, found thirteen cases in which both kidneys were displaced.

ever, that a prolapsed hepatic flexure of the colon drags its peritoneal attachment down and to the front of the lower pole of the right kidney — a fact interesting from both an anatomical and a surgical point of view. One must remember, also, that the kidney has no proper ligamentous supports, and that its close relation to the tireless diaphragm renders it a victim to pressure from above with every breath that is drawn. Consequently, if the liver and diaphragm are prolapsed as a result of lax abdominal walls and sagging intestines, there will be a constant pounding by the liver, tending to force the kidney downward with each respiration. It is well known that the left kidney is less prone to wander than is its fellow, the proportion being about once for the left kidney to ten times for the right kidney. Keith explains this by pointing out the close union of the spleen and the left kidney; now, the spleen is held in place by a suspensory ligament binding it to the diaphragm. Then, too, the stomach, which descends upon the left kidney, is a less heavy hammer than is the liver. Moreover, the splenic flexure, even when forced downward by a contracted diaphragm, is in a position to exert a certain amount of upward pressure; and the splenic flexure moves in and out of the left infra-diaphragmatic space according as the stomach is full or empty. Certainly the splenic flexure of the colon is less likely to be prolapsed than is the hepatic flexure; hence it is a useful supplementary support to the left kidney.

Most women with movable kidneys are unaware of renal disturbance; such symptoms as they have are not referred distinctly to the displaced organ. On the other hand, though a patient have a kidney prolapsed

in the first degree only, that errant kidney may cause severe symptoms. The case is parallel to that of a patient with a breaking-down plantar arch of the foot. When a foot is beginning to break down, the resulting symptoms may be severe enough to call urgently for relief. So with a kidney beginning to slip. Rarely, indeed, will slight displacements of the kidney require operation, but the physician must not forget that operation eventually may be demanded.

When slight displacements cause acute symptoms one will find often that the ptosis is due to an injury, to a fall, a strain or a wrench of the body, or to heavy lifting. A prolonged bicycle ride has been known to induce this condition. In making the diagnosis, assure yourself that the kidney is at fault and that you are not dealing with a lesion of the sacro-iliac joint.

Another aspect of renal ptosis is that presented by a kidney long recognized as floating and hitherto harmless, which, on a sudden, causes severe and distressing symptoms. The symptoms may be so serious as to suggest appendicitis; and, seen after the acute symptoms have subsided, there may remain so much local tenderness as to puzzle the physician and leave him in doubt whether the appendix or the kidney be at fault.

Clinicians talk of "Dietl's crises" as characteristic of floating kidney. Dietl's crises are supposed to be due to a twist or kink in the ureter of a floating kidney or to a twist in the renal vein. Some experimenters believe a twist in the vein to be the more usual cause. So they explain these crises by venous stasis rather than by acute hydronephrosis. During such laboratory investigations no important changes are seen to take

place in the kidney when the ureter is ligatured, nor does the amount of secreted urine vary. But when the renal vein is ligatured, the kidney immediately increases in size. On the other hand, a number of cases have been observed clinically in which the acute symptoms of Dietl's crises were followed by the appearance of a fluctuating tumor in the loin, associated with marked diminution in the amount of urine passed. Then the tumor has disappeared, and concurrently the patient has experienced an imperative desire for micturition, with the passage of a large amount of pale urine. Such is the conflicting evidence. Commonly, clinicians credit the attacks to kinking of the ureter, a blocking of urine in the pelvis of the kidney, and a resulting acute hydronephrosis. Whatever the explanation, it is a fact that in a number of cases in which there is a floating kidney there are repeated attacks of pain and distress. These attacks, or Dietl's crises, begin frequently with a sense of weight and discomfort below the border of the ribs and near the median line; sometimes the first symptoms are pain in that region and nausea followed by vomiting. If the symptoms persist, the affected area soon becomes tender, so that one suspects peritonitis. Often the patient experiences palpitation of the heart; the symptoms become very distressing; sometimes the mental condition suggests hysteria. The crisis may persist unabated for several days or it may last but a few minutes. Frequently, one may replace the kidney and relieve the symptoms by removing the clothes, by posture and by manipulation, — the patient being in a hot bath if necessary.

The experienced observer will notice that these symp-

toms are similar to those seen in the gall-stone attacks caused by a calculus attempting to engage in the cystic duct, but not passing out of the gall-bladder. Such hepatic colic is relieved usually by measures similar to those just described. It is associated with no other distinctive features of gall-stone disease, as jaundice or tumor of the gall-bladder.

Keith says that enteroptosis is an important cause of gall-stone formation. The descent of the liver carries with it the fundus of the gall-bladder, while the neck of the gall-bladder and the cystic duct are fixed by the gastrohepatic omentum to the central portion of the diaphragm — the portion least displaced. The more the liver drops, the more it forces down the head of the pancreas and the duodenum, and with the duodenum the opening of the common duct. Thus the bile-ducts, held firmly at one end and stretched at the other, change their relations to each other and to the neighboring organs. The cystic duct no longer enters the common duct at an angle of about forty degrees, but the two ducts lie nearly parallel to each other. There results stasis of bile in the gall-bladder, and thus the production of gall-stones is favored. We do not agree with Keith, when he says that gall-stones are " commonly, if not always, present in cases of enteroptosis." We admit, however, that gall-stones are frequently found associated with displaced viscera. As we have shown, gall-stone colics and Dietl's crises may simulate each other. One must differentiate carefully.

Some clinicians have stated that a floating kidney may press on the intestine or on the bile passages and so cause serious intestinal obstruction in the one case,

or disabling pain and jaundice in the other. Proof is lacking that a kidney ever produces such mischief. Transient intestinal and biliary obstruction may thus be caused, but severe and protracted disorders probably never.

Recurring renal crises make life a burden. The unfortunate victim never knows when or where the attack may seize her. When it comes, she must be prepared to loosen her clothes, apply heat, and call for the masseuse.

As the prolapsed kidney may come in contact with the bile passages above, so it may drop upon the appendix below. The appendix lies in its path. We have told how one may mistake a tender kidney for a diseased appendix; more than that, an errant kidney may actually irritate the appendix and so cause a chronic appendicitis. So we must study carefully the nature of recurring pains in the renal-appendix region. Renal crises do not kill; chronic appendicitis may become acute and lethal at any moment.

A. T. Cabot has pointed out that hæmaturia may result from ptosis of the kidney. Sometimes the bleeding is profuse and alarming, sometimes it is slight but constant. For this symptom of hæmaturia we must operate; and when we have the kidney exposed and in hand, we must look in its pelvis for a small calcareous scale which the X-ray has not shown.

Once we saw malignant disease developing in a left kidney known to be displaced for many years. Such cases have been reported rarely. In our case the ptosis probably did not cause the malignant growth.

How anticipate the crises? Proper bandaging will

prevent attacks in many patients; and when bandages fail, we must operate.

The treatment of floating kidney involves the treatment of general abdominal ptosis in a great many cases. One must study all the symptoms of the patient. Often one must perform an exploratory operation in order to make a diagnosis. By anchoring the kidney, biliary and appendiceal symptoms will be relieved frequently; therefore, when the symptoms are complex and obscure, it is well to open the abdominal cavity in front. Thus mistakes will be avoided. Edebohls explores through a lumbar incision for all suspicious symptoms in the right side of the abdomen, but his method is not satisfactory to the average operator.

Often one has to ask oneself, Will an operation relieve these painful renal symptoms? If a patient has the general symptom-complex, neurasthenia, let her kidney alone, even though kidney symptoms predominate. Rarely will the pains of such a neurasthenic patient be relieved, for new pains and new symptoms will develop in other organs, if not in the region of the anchored kidney, and the last state of that patient will be worse than the first. Rather should one try first the use of supporting bandages in such a case, and ascertain the condition of the patient's pelvic floor. Build up her general health, and do not desperately operate for the sake merely of "doing something."

Now there are certain invalids, few in comparison with the number of persons with displaced kidneys, — certain invalids who really do have so much trouble from persistent hæmaturia, from the frequency of their renal crises, or from the constant dragging sensation

and the burning pain along the line of the iliohypogastric nerve, that they demand operation. The patient may indeed be nervous or irritable, — what wonder! — but the pain and discomfort are constant and are found in the same location always. The true neurasthenic element is lacking. Such a patient may be a permanent invalid, nearly bedridden, always debarred from prolonged exertion, and cut off from the possibility of earning a livelihood. Operation will generally relieve the sufferer, and her chance of cure by operation is very good indeed.

These severe cases of renal ptosis often may be relieved, however, by bandages and pads, which are serviceable in the treatment of other forms of abdominal ptosis. In these cases the bandage is an appliance scorned by the many and properly used by the few. Yet all surgeons should understand its use. They must employ it in most cases, for most cases, especially complicated cases, do not lend themselves to operation. Certain surgeons argue that a band compressing the lower part of the abdomen, or a pad in front of the kidney, cannot possibly push the prolapsed organs or organ into place. Surely such reasoning is true, but it is beside the mark. The man who makes such statements disregards or fails to comprehend the nature of visceral ptosis. Moreover, in many cases physicians do not apply these apparatus skilfully or intelligently. *One must replace* the prolapsed organs before applying the bandages. A surgeon does not attempt to bandage a dislocated shoulder before he reduces the displaced bone. In bandaging for ptosis the surgeon must use the same pains and nice care that he

would use in fitting any other piece of orthopædic apparatus.

In order to replace the prolapsed abdominal organs, lay the patient on her back, with the hips elevated, — in a modified Trendelenburg position; manipulate and knead the organs into place, — stomach, kidney, or intestines; and then bind them in position with the bandage.

What bandage shall be used? There is the difficulty. There has been a great deal of discussion of that question, and experiment and failure to find the correct bandage. Here is a simple device, which we have found satisfactory invariably: Apply a roller bandage to the abdomen just as one would apply a roller bandage to the shoulder. The abdominal roller should be of flannel or canton flannel, cut straight, six inches wide and from six to ten yards long. Before beginning to apply it, see that the patient is properly elevated and that the viscera are rolled up towards the diaphragm. Begin bandaging by taking a binding turn about the patient's thigh; then quickly, smoothly, and firmly bandage the abdomen from pubes to ensiform. The bandage must lie fairly tight at the bottom of the belly, but looser at the top. It fits perfectly; it feels snug and secure. The patient will experience relief almost instantly.

If this bandage is satisfactory and the patient wishes to go on with such treatment, the physician may have constructed an easily applied belt, but the patient will find no apparatus so comfortable as the simple roller bandage. The straight-front corset, properly fitted, is favored by many clinicians and is very successful.

There remain a few cases which bandages do not relieve; in which, if the kidney obviously is at fault, and its fixation is demanded, the surgeon had best operate. He should approach the renal region through a flank incision. We shall not dwell on details of the various operations. Sundry operators laud sundry methods. We follow the method of partial enucleation and capsule-stitching prescribed by Edebohls, and we are satisfied.

Wise surgeons insist that the kidney must not be replaced and stitched *high*. That is rational advice, for, though one may not agree with Keith in all his conclusions, especially as regards the clinical significance of many symptoms, nevertheless he demonstrates clearly that an important factor in the production of enteroptosis is the contracted infra-diaphragmatic space. Consequently, with each breath the liver is forced downward against the underlying organs. Clinical observations show that simple displacement of a kidney rarely suffices to provoke severe symptoms; other factors must be present if serious trouble is to result. So we attain no important end if we replace the kidney in its normal position; while by anchoring it low, we relieve it from the hammering of the liver.

So much for floating kidney. It is a subject frequently debated, and surgical dust-bins groan with the discussion.

The spleen, too, may drop. It is supported in part by the costocolic ligament, which lies beneath it; it is fastened to the left kidney by the ileorenal ligament. Furthermore, it is joined to the stomach by the gastrosplenic omentum. Frequently the spleen is so enlarged

as to appear beneath the border of the ribs; but it has little tendency to "wander." If a rare wandering spleen does exist, it still more rarely gives rise to special symptoms demanding treatment. However, some serious cases have been reported as causing annoying symptoms, so that the operation of splenectomy had to be done. Halsted has replaced at operation the wandering spleen several times and has fixed it by gauze, packed in below to promote the formation of adhesions.

The liver occupies a unique position in relation to abdominal ptosis, for it participates to a certain extent in nearly all these displacements, and doubtless hastens by its bulk the descent of other still resisting organs. The movement of the liver under such circumstances is downward and forward, and involves a certain amount of rotation on its axis. The right lower border is crowded down till it extends below the margin of the floating ribs. Much of the substance of the liver is found to lie beyond the border of the ribs, well out in the abdominal cavity. In spite of this displacement from its normal position, rarely is the mass of the liver found to be distinctly movable. In most cases the large and strong supports maintain their relative positions and the organ cannot often be described as "floating," as one would say of the right kidney. In certain rare instances, however, true floating liver is found. The organ is then distinctly movable and gives rise to symptoms which can be remedied by operation only. Sundry denuding and suspending operations on the liver have been tried, but none has been found entirely satisfactory as yet.

The pancreas has been thought to be concerned little with general ptosis. To be sure there is that dispute between Glénard and Ewald as to the interpretation of a band felt to lie across the spinal column in front; is it the collapsed transverse colon or is it the pancreas? At any rate all observers agree that the body of the pancreas generally remains immovable. Rarely, however, when the liver is forced downward, the duodenum may be crowded before it and at the same time the head of the pancreas may be carried almost to the brim of the pelvis. All that is a serious business, and operations done hitherto for such grave derangements have been palliative mostly, and not altogether satisfactory at that.

Finally, note this, that as yet the only operations which are generally recognized as giving complete relief in cases of marked enteroptosis are operations on the kidney and on the stomach.

As for the broad subject of abdominal ptosis, we have dealt with it in outline only. Until recently few surgeons were concerning themselves with the matter, though internists were keenly alive to its importance. We hope we have shown that enteroptosis is a condition common and grave, and that it offers a field for the activities of the surgeon as well as of the physician.

CHAPTER XII

THE APPENDIX VERMIFORMIS

Of all the abdominal organs concerned with digestion, the appendix vermiformis, probably more often even than the stomach, is the seat of serious disease. Before its capacity for mischief became thoroughly understood, it was thought that inflammation of the appendix is comparatively rare, and it is well within recent memory that European writers referred to appendicitis sceptically as the American disease. But our present better knowledge of the danger lurking in that little organ has taught us that frequently its disease processes are latent and obscure, that the symptoms are often misleading and the diagnosis difficult, that obstinate dyspepsias and prolonged ill health have their origin in the inflamed appendix, and that chronic appendicitis especially, for that is the subject of this chapter,[1] is a very real thing and a very proper term. Deaver[2] says, "Every appendix which has once been the seat of inflammation is the seat of interstitial changes, and except in the rarer cases of hydrops *or when adhesions are present*, the organ is harmless until an acute process is engrafted upon it." But adhesions are nearly always present when once the appendix has been inflamed, and interstitial changes have sequelæ out

[1] The writers cannot accept Deaver's dictum, "The expression 'chronic appendicitis' has also but little meaning." *American Medicine*, Oct. 17, 1903.

[2] *Ibid.*

of all proportion to the apparent extent of those changes.

As has been pointed out by a careful observer,[1] the relation of the appendix to the alimentary canal and the peritoneum must be borne in mind in this discussion. In the process of development or retrogression the appendix has been tucked back out of harm's way, coming to rest upon the posterior and inner surface of the cæcum in a deep and well-marked fold, which approaches the completeness of a pocket or pouch in the peritoneum; hence inflammations of the organ tend to remain localized, and the omentum glues over the beginning process, wrapping around the inflamed appendix. Whereas in the fœtus the appendix constitutes a very considerable organ as compared with the cæcum, at the fourth month of intra-uterine life its proportion to the cæcum being about as one to five, at birth it approximates to the adult form and size, its proportion to the cæcum being about one to fifteen. As infancy and youth advance this disproportion becomes more and more marked, until the cæcum has overgrown and crowded the appendix to such an extent that the latter has become pushed upward, backward, and usually inward so as to appear as a mere spiral projection from the posterior aspect of the cæcum. This position it reaches about the fifth year.

After this the developmental changes produce no further disproportion, but other changes go on. Although the appendix does not diminish further in size, a steady and constant obliteration of the function of its mucous

[1] Woods Hutchinson, "Appendicitis as an Incident in Development." *American Medicine*, Aug. 1, 1903.

coat continues through life. These observations are Hutchinson's, and he quotes "Ribbert and other anatomists" to show that there is a steady increase in the percentage of obliterated appendices with each successive decade of life. By the thirty-fifth year this has reached 25 per cent of all cases. By the forty-fifth year nearly 50 per cent are occluded, by the fifty-fifth year 60 per cent, and by the sixty-fifth year nearly 70 per cent. Obviously these figures correspond closely with the age liability to appendicitis, increasing from childhood to about the thirtieth year, and after that diminishing steadily as more and more of the appendices become occluded. And these obliterations of the appendix are not, as was first thought, due to a normal process of involution, for every surgeon of experience frequently has seen at operation or at autopsy evidences of old inflammation: scars, bands, adhesions, the disappearance of normal peritoneal folds, and not infrequently segments of the appendix actually cut off, as it were, and lying free as foreign bodies in the mesentery.

From such observations, and from the immense clinical experience now at our command, may we not conclude that a large number of cases of mild appendicitis are recovered from permanently? Though in youth, as we know, recurrences of acute attacks are common and to be expected, even so Fenger has found that about one-third of the severer type of cases show no recurrence.

With this statement of what appear to be well-authenticated facts, it seems as though we were often justified in regarding appendicitis as a chronic disease clinically, and subject to acute exacerbations. The

inflammation may not always be active, but symptoms are very constantly present; and it is proper, therefore, to include the condition among *chronic digestive disorders.*

As Kelly has recently brought home to us, appendicitis is no new thing, and other writers, notably Edebohls,[1] have collected a voluminous literature. But nearly twenty years ago Fitz told how Saracenus in the seventeenth century described an appendicular abscess, though its meaning was not apparent to him, and how, in 1759, Mestivier of Bordeaux wrote of a perforated, diseased appendix found at the bottom of an abscess cavity. Kelly has described the same case as well as that of one Joubert Lamotte, a French medical student, who reported in 1776 finding a "petrified foreign body" in the appendix of a person who had died of tympanites. Kelly goes on to relate the early writing by Jadelot in 1808 on the subject, and by Wegeler in 1813. In 1824 there appeared a paper by Louyer-Villermay, entitled "Observations to serve for the History of Inflammations of the Cæcal Appendix." In this paper he related two typical cases, each with the necropsy, and Kelly properly concludes that to Louyer-Villermay belongs the honor of having been the first to point out the importance of appendicular inflammations. Three years later, in 1827, Melier published a memoir on the subject, based on a case of his own, on a study of two others detailed by Louyer-Villermay, and on two new cases. He described the lesions in the appendix, and even had a notion of the possibility of surgical intervention.

[1] G. M. Edebohls, "A Review of the History and Literature of Appendicitis," in *New York Medical Record*, Nov. 25, 1899.

These ideas did not find favor with Dupuytren, then the great surgical authority in France. But it is not probable that the negation of Dupuytren himself placed any serious obstacle to surgical advance in this field. Our art was not then ripe for operations within the abdominal cavity. In the forties, the Englishman Hancock advocated opening abscesses in the right iliac fossa, and in the sixties Willard Parker of New York elaborated the procedure. Numerous other surgeons, especially in America, pursued the same line of work; but it remained for Fitz,[1] in 1886, finally to explain the conditions present, and to establish the rationale of operative measures. And be it noted that his paper was founded on post-mortem observations, and was published at the exact fructifying moment when surgical thought was centring upon the subject, and in the midst of the new era of abdominal surgery made possible by the general adoption of antiseptic methods. For McDowell and Marion Sims, pioneers in pelvic surgery, were needed, with Lister, before surgeons began to mount upward in their operating; and in that upward trend toward the diaphragm after leaving the pelvis, the appendix was the first diseased organ to be attacked.

The influence upon digestive processes of the appendix long diseased has been apparent only in recent years, but that attacks of severe inflammation in the cæcal region have been recognized for centuries we know; for in addition to the cases already cited do we not read of that often quoted "Essay on the Iliac Pas-

[1] "Perforating Inflammation of the Vermiform Appendix, with Special Reference to its Early Diagnosis and Treatment," R. H. Fitz. (Read before the Association of American Physicians, June 18, 1886.)

sion," written by Thomas Cadwalader of Philadelphia in the first half of the eighteenth century? Fitz quotes Goldbeck's thesis, published in 1830, in which Goldbeck adopted the French view and used the term "perityphlitis," and also quotes John Burne of London; but among them all the causative function of the appendix in producing these inflammations went mostly unperceived, and so Fitz goes on with the following words, which have become historic, and mark the first use of the name of one of the commonest of diseases, "As a circumscribed peritonitis is simply one event although usually the most important in the history of inflammation of the appendix, it seems preferable to use the term 'Appendicitis' to express the primary conditions." He proceeds to point out varieties of appendicitis, to indicate certain of the well-known pathological changes, and to quote certain remarkable observations of others, notably those of Toft, as referred to by With, in which Toft stated that he had found the appendix diseased in one hundred and ten out of three hundred autopsies, every third person, by his estimate, thus possessing a diseased appendix, — an interesting statement to have been made twenty-five years ago, when we compare it with the findings of Hutchinson and Ribbert already mentioned.

In the early days, when we were still talking about perityphlitis, and when the importance of the appendix itself was not fully recognized, surgeons were already operating for abscesses in this region; and Willard Parker, in 1867, was the first boldly to seek drainage for these collections while the pus was still deeply seated, but he sought it by a low incision and along the so-called extra-peritoneal route. It was John Homans, a

pioneer in ovarian surgery, who was the first, in 1887, to open an appendix abscess directly by the trans-peritoneal route.

It is not the purpose of the present writers to enter upon an elaborate discussion of the pathology and operative methods employed in *acute* appendicitis, as that subject is scarcely within the limits of our title; but it is interesting to note the stage at which the recent discussion of treatment has arrived in the writings of certain surgeons in this country.

From the time of Fitz's first publication on the subject two apparently opposing views have been held regarding the initial treatment of acute appendicitis. At first and in a great majority were those practitioners, both physicians and surgeons, who maintained that early surgical intervention was a great risk, that by early intervention the patient's life was needlessly jeopardized, and that the time to operate was after a well-defined abscess had been formed. There were those who went still farther and asserted that practically all cases could be cured by the old-fashioned medical means, — opium, poultices, and a limited diet. These last conservatives soon became a discredited minority, and the attitude of those opposed to early operation centred more or less upon the proposition that the inflammatory process could be checked and eliminated by poultices and saline catharsis; for they argued that by such means drainage was brought about through the natural channels. However, if an abscess formed later, they would open it. Traces of this line of argument are still to be found at times, but sound practitioners have long abandoned it, if indeed they ever entertained it. It

needs but a glance at a perforated, inflamed appendix, pouring out its poison into the surrounding tissues, to appreciate at once how frightfully dangerous would be any treatment calculated to increase this outpouring. On the other hand, beginning with a small but zealous band of radical operators, there has developed a class of surgeons who feel that every case of appendicitis should be operated upon as soon as seen, unless it is obviously quiescent and the patient convalescent. This attitude is well expressed in a paper published by Deaver,[1] in 1903: "It suffices to say that even a hasty glance at the case records tells again the old and oft-repeated story. The mortality is in direct proportion to the extra-appendicular involvement, the latter being dependent upon the duration of the disease and the character of the infection. While every surgeon of experience is urging the need of early operation and impressing the evils of delayed operations upon the general practitioner as well as many surgeons, yet, nevertheless, case after case is sent to us, reeking with pus or slimy with exudate.

"The peril of waiting for the interval is not only due to the evil caused by the accumulating pus, but, in a far greater measure, to the danger into which such teaching may lead the medical man or layman. . . . If immediate operation were universally practised, there would be no necessity to devise methods to restrict the spread of infection. In the early hours of the attack the removal of the diseased appendix eliminates the source of infection before the latter event has taken place, and the surgeon has merely treated a case of

[1] "One Year's Work in Appendicitis," by John B. Deaver, *American Medicine*, Oct. 17, 1903.

appendicitis, a trifling matter and not one of virulent peritonitis. . . . I conclude with the tiresome but necessary statement that an early operation, preferably in the stage of appendiceal colic, is the only rational procedure and is the only treatment which will reduce the mortality in acute appendicitis to insignificant figures."

Deaver's paper is founded upon five hundred and sixty-six cases, and the mortality by such treatment as he advocates is shown to be 5.3 per cent. He summarizes in the following two interesting tables: —

TABLE I

Peritonitis, general	16	5 deaths	31%
Abscess cases	183	22 deaths	12%
Appendicitis	367	3 deaths	0.8%
	566	30 deaths	5.3%

TABLE II

Adults, acute	344	26 deaths	7.56%
Adults, chronic	164	——	——
Children, acute	49	4 deaths	8.16%
Children, chronic	9	——	——
	566	30 deaths	5.3%

It appears that Deaver operates in all cases of acute appendicitis as soon as they are seen, for he divides his list into three classes upon all of which he advises an immediate operation: first, general or diffused peritonitis; second, cases of localized abscess; third, cases in which the disease is confined to the appendix.

The foregoing statements of Deaver represent the positive views of those surgeons who would operate at once. A modification of these opinions is advanced by another sound and experienced surgeon, Willy-Meyer,[1]

[1] "What can we diagnosticate in Acute Appendicitis?" *American Medicine*, April 11, 1902.

who says that unless he finds immediate indications for operative interference he places a patient with a pronounced first attack under the most careful observation. In pronounced second attacks immediate operation is urged. If within the first twenty-four or forty-eight hours after the onset of the first acute attack the patient's pulse goes up to one hundred and sixteen or one hundred and twenty and remains there for several hours, and if the pain and tenderness are pronounced, an operation is performed at once. A high temperature is another indication for operating; and most surgeons would add to this a rising leucocytosis, especially if above fifteen thousand. Willy-Meyer says further that with a moderate temperature, rapid pulse, and marked pain and tenderness, and particularly if a chill occurs, he proceeds with the operation. "The surgeon must also be somewhat guided by the general appearance of the patient," but it is his custom to operate when in doubt. The converse of all this is that when the familiar signs of appendicitis are abating and the picture is improving, he withholds his hand. Such are the statements of two surgeons of recognized position, and they represent fairly well the attitude of a large class in this country. Though there is apparently a slight divergence in their views regarding the choice of time for operating, it is probable that if they were confronted with identical cases at sundry times, their opinions and advice would generally be in accord.

At the same time that such practice has become widespread, so that it is regarded by the mass of the profession and by the intelligent among the laity as

conservative practice, it must have been constantly evident to a critical observer of surgical opinion that such practice has never met with the unqualified approval of all thoughtful operators. The novelty of many of the situations presented, the long-existing uncertainty as to the anatomical conditions actually present with a definite set of symptoms, the sentiment that there is much yet to learn, and that we are still feeling our way, — all this has made certain men doubt at times whether immediate operation, in all cases and at all stages of acute appendicitis, invariably was justifiable.

This sentiment found voice through A. J. Ochsner of Chicago, first at the Saratoga meeting of the American Medical Association in 1901. The procedure he advocated has come to be known as the "Ochsner treatment," though indeed it is but an elaboration of views widely held, but condensed, defined, and brought to a rational perfection by their present advocate.

Ochsner said again in 1903 :[1] "This form of treatment cannot supplant the operative treatment of acute appendicitis, but it can and should be used to reduce the mortality by changing the class of cases in which the mortality is greatest into another class in which the mortality is very small after operation.

"I wish to say here, as I have said everywhere before, so long as the infection is within the appendix when I make the diagnosis, I operate immediately if I can obtain the consent of the patient.

"There is, however, a time which comes to every

[1] Statement by A. J. Ochsner ; Meeting American Medical Association, New Orleans, 1903.

surgeon, when we cannot say with any degree of certainty that the particular patient under consideration will get well if we operate at once. This class of patients, under the best possible conditions and with the best possible surgeons, will produce a mortality of from 15 to 30 per cent if they are operated on at once as soon as the diagnosis has been made. I wish to say that with those cases we do not know what will happen if we operate at once. We do know, however, that in 97 per cent of all such cases suffering from perforative or gangrenous appendicitis the patient will get well, provided we follow out the plan outlined in the above conclusions, namely, that of washing out the stomach, and giving absolutely no cathartics and no food of any kind by mouth and giving no large enemata until the patient has been normal for at least four days."

Woods Hutchinson, in his article already quoted, argues that from the anatomical relations of the appendix we must conclude the "Ochsner treatment" to be a rational one, "for Ochsner's series shows a mortality of barely 4 per cent, while Deaver's was between 14 per cent and 15 per cent." This statement illustrates merely the unreliability of statistics and of conclusions from a few cases, for in 1903 Deaver's mortality in a larger number of cases was but 5 per cent.

The writers believe that, on the chances, *most* competent surgeons would agree early cases should be operated upon at once, that abscesses should be opened, that general peritonitis should be drained, and that from chronic cases the appendix should be removed. The discussion really centres about those acute cases which

have entered upon the third or fourth day of the disease. We believe that in these cases most surgeons would watch the case for a few hours, while employing the "Ochsner treatment"; that if pain, rigidity, spasm, fever, pulse-rate, and leucocytosis increased or failed to mend, they would operate; but that if improvement were obvious, they would delay operation until a localized abscess had formed or until "the interval."

Supremely interesting as is the consideration of acute appendicitis, that condition must be regarded for our purposes as an incident merely in the course of a relapsing or chronic appendicitis, which is truly one of the most fruitful causes of certain digestive disorders. A case from our list will illustrate what is meant. Some four years ago there came under our care a college student, twenty-one years of age. He was a robust, well-developed, athletic young fellow, a football player, of excellent habits and wholesome mode of life. Three years before we saw him he was supposed by his physician to have contracted malaria. Every six or eight weeks he had for four or five days attacks of malaise, with headache, slight pyrexia, occasional nausea, and general abdominal discomfort. Between these attacks he regarded himself as well, but he confessed to a delicacy of digestion, — hearty meals distressed him, — and an irregularity of the bowels with alternating periods of constipation and diarrhœa. These conditions had continued without especial change. The young man had sought various advice, had travelled in search of health, and had lived in sundry places. Finally, during one of his remissions he happened to consult us, when on a careful abdominal examination a sensitive, not

painful, point repeatedly was made out in the right iliac fossa. Convinced that his appendix was at fault, even if it was not the source of the trouble, we removed it. The patient's recovery of health was prompt and permanent.

In such cases as this the patients will assure you after the operation, as time elapses, that they never felt so well before; that they have a sense of well-being hitherto unknown; that they feel stronger every year; that they are now entirely free from all dyspeptic symptoms or irregularities of the bowels, and other such comforting statements. Of course, examples like the one above cited are not typical of all cases of chronic appendicitis. It is impossible to determine how large a ratio they bear to the whole number, but they are commoner than most physicians appreciate. The more general understanding of chronic appendicitis conceives of that class which is often and perhaps more properly called relapsing appendicitis, and even this class has not received that attention it deserves. The writers of text-books refer to it rather casually, while they devote chapters to the acute form of the disease. Says Osler: "The patient gets well, . . . then in three or four months he again has signs of local trouble. The attacks may recur for years. The cases which recover with the persistence of an induration or tumor mass are most prone to relapse. There are more severe cases, in which the intervals between the attacks are very short and the patient becomes a chronic invalid. The frequency of recurrence is difficult to estimate. Fitz places it at 44 per cent, Hawkins at 23.6 per cent."

The liability to relapse in appendicitis has long been

recognized. More than twenty years ago Pepper[1] mentioned it. In 1885 Whittaker, writing in Pepper's "System," said, "In all cases relapses are very frequent, as repeated occurrences of the disease constitute the rule; . . . a case may terminate fatally in a few days, or may extend itself over months, or with its effects over years or for life."[2]

In the case of the football player there had been no severe acute attacks, — indeed, it seems scarcely correct to call the case "relapsing"; but there was a marked degree of invalidism, which was terminated by removal of the appendix. The conditions found inside the abdomen differed very little from the normal. All the organs appeared sound, even the appendix itself. But it was attached to the ileum by a single stout adhesive band, and the mucosa and muscularis were infiltrated and thickened near the tip.

That matter of adhesions is interesting and important. Often on gross inspection nothing except adhesions is to be made out. In the early days of these operations one used to hear surgeons say: "That is a normal appendix. There is nothing there but a few adhesions." Now, adhesions mean very definite conditions. They mean a previous inflammation and the possibility of another; but more than that, usually they mean present and persistent discomfort, pain, dyspepsia, irregularity of the bowels, and impaired health. And these symptoms are due to mechanical causes. An appendix tied up to the colon, the mesentery, the omentum, the ileum, or the

[1] "Contribution to the Clinical Study of Typhlitis, etc." Transactions Medical Society of Pennsylvania, 1883.

[2] The older statistics of Volz made relapses 80 per cent of all cases.

brim of the pelvis, tends to restrain the normal movements of those organs, and more especially it limits the proper distention of a loaded cæcum. The dilated bowel drags upon the appendix, pain and a train of reflex symptoms are caused, and the patient seeks comfort by the use of laxatives, stomachics, and tonics, all of which give him but temporary relief at the best. He comes to regard himself as a confirmed dyspeptic. He becomes the despair of the doctors, if the true condition be not ascertained; and he drags on a more or less wretched existence, a weariness to himself and in danger of falling a victim to an acute and possibly fatal appendicitis. This picture is one which has now become familiar to all physicians of large experience, and the following cases will serve to illustrate more vividly the apparently trifling conditions which may bring a person into such a state of ill health.

I. A young girl of seventeen, with stomach-ache and chronic constipation, consulted us. She said that every three or four days she found herself severely constipated, though on the intervening days her bowels moved regularly. The constipation was associated with grumbling pain for several hours in the umbilical region. An enema usually brought a movement associated with increased general abdominal pain, subsiding in about an hour. These conditions had existed for some two years. Of late her appetite had become capricious and food amounting to a "square meal" always distressed her. She was losing flesh and strength, her catamenia were becoming scanty and irregular, and she was thought to be "in a decline."

Careful observation of the case and repeated exami-

nations of the abdomen convinced us that her appendix was at fault. The stomach was of normal size and position, an analysis of the gastric secretions and an investigation of the motility revealed nothing. The pelvic organs were sound, and except for a rather abnormal tympany, the intestines appeared to be as they should.

There was present, however, a constantly palpable appendix which was distinctly tender when rolled under the fingers.

The abdomen was opened; the appendix found lightly adherent to the ileum, kinked in the centre, and slightly indurated toward the tip. It was therefore removed.

The report of the pathologist stated, "The appendix was 5.5 centimetres long, somewhat thickened with adhesions toward the tip; chronic appendicitis."

This young girl made a prompt recovery. The action of her bowels became regular and normal, pain disappeared, her appetite returned; she gained twenty pounds in six months, and now after a year she is perfectly well.

II. A lad of twelve, a schoolboy, in comfortable circumstances, came to us with his mother about a year ago. The story was that, though well grown and vigorous, he had occasional attacks of constipation, for which castor oil was required; and that accompanying this condition there was usually excruciating frontal headache. On account of these attacks he would lose four or five days of school out of every month.

The case was referred back to the family physician with general advice about hygiene of the bowels and about cold bathing.

A month later we were asked to see him in the midst of one of these attacks. There was severe headache, the bowels had not moved for two days, the temperature was 102° F., and the pulse rate one hundred and ten. The abdomen was uniformly tender, but there was nothing localized. Eight hours later we saw him again. The symptoms continued; the temperature had risen to 103° F., and the pulse to one hundred and forty. The leucocytosis was eighteen thousand. There was great discomfort and restlessness. At this time careful palpation repeatedly practised in the right iliac fossa revealed marked tenderness at McBurney's point.

We removed the appendix at once. Adhesions were found, slightly kinking the organ at its middle; otherwise, grossly, it appeared normal. The pathologist reported: "The appendix was five centimetres long, with many adhesions on the outside. The mucous membrane was normal. Chronic appendicitis."

The wound was sewed up tight, the lad's convalescence was uneventful; he was up and about at the end of two weeks.

The operation seems to have banished his headaches and constipation. At any rate, they have not returned. His general health is better than formerly and his digestion and bowel action "perfect."

III. A sea-captain from Cape Cod, fifty-nine years old, consulted us about three years ago. He said that for twenty-five years he had been a chronic dyspeptic, and during his voyages had consumed all the "doctor's stuff" on which he could lay his hands. Of course his diet, while at sea, was atrocious, but that could not be helped. For five years he had "laid ashore," but

was worse rather than better. Occasionally he had colics in the umbilical and epigastric regions, relieved by the passage of much flatus. His diet had little bearing on his symptoms. His bowels were always constipated, and though he was well developed, his flesh and strength were below the normal.

An examination of the stomach showed that viscus to be in its proper place and not dilated. There was good motility and the gastric secretions were not abnormal. The thoracic and abdominal organs seemed normal, except that there was slight tenderness along the right costal margin, and in the right iliac region what felt like a resistant mass about the size of a lemon.

An exploratory laparotomy was advised with the expectation of finding malignant disease of the cæcum; but there was none present, nor was there evident disease of the biliary passages. There was found, however, a considerable mass of adhesions tying up the cæcum and appendix in the omentum. When freed, the appendix was found to be about three inches long, much thickened, and nearly cut in two by a band at about its middle. The pathologist's report stated merely, "The appendix was three inches long, adherent to the omentum, and much thickened; chronic appendicitis."

This case was particularly gratifying for the complete relief of symptoms which followed the operation. The man recovered as promptly as a child, and for three years has been well. He eats freely of what he chooses, has no dyspepsia or pain, has gained twenty pounds, and tells us he feels like a boy again.

IV. This was the case of a man forty-eight years old,

and on account of complications was not so satisfactory as the foregoing. We had seen him in consultation some ten years previously, when he was in the midst of an attack of localized left-sided peritonitis, due to what we then believed to be a stercoral ulcer at the splenic flexure of the colon. He had recovered at that time, and his left-side symptoms had long since disappeared. At the time of which we are now speaking, a year ago, he stated that for five years he had had frequent attacks of "biliousness" with great depression, nausea, "bloating," and constipation. Occasionally these symptoms would be accompanied by pain in the right hypochondrium. He suffered also from headaches, confusion, and loss of mental grasp. His ill health had forced him to give up his business, and he informed us gravely that he would prefer to die rather than continue as he then was.

The physical examination of the case was not very satisfactory, and we could not convince ourselves that for many of his symptoms he might not be put in the category of neurasthenics, — that convenient category in which we are wont to shroud so much of our ignorance. However, after watching him for some weeks and consulting with a competent neurologist, we became convinced that here was a definite abdominal lesion or complex of lesions which surgery might remedy. So far as our examination went, it discovered an abdomen somewhat distended constantly, slightly tender over the whole colon, and markedly tender in the right hypochondrium, in which region he indicated recurring discomfort and pain.

Accordingly we operated, making the abdominal

wound through the right rectus above the umbilicus. Throughout the right side of the abdominal cavity we found light adhesions, attaching the colon to the gall-bladder, the omentum, and the ileum. The cæcum especially was implicated, but most interesting was the condition of the appendix. At first sight it seemed to be represented by a thickened stump merely, about half an inch long; but a further search revealed the remainder of the organ, cut into three sections by the old inflammatory process, — like separated links of a chain, each link lying free in the mesentery at an interval of from one to two inches from its fellows. On their removal these segments of the appendix proved to be obliterated, except the proximal stump, in which there remained a patent lumen. We completed the operation by breaking up all the visceral adhesions.

The patient recovered slowly. There were no immediate complications, but the man's health had been greatly impaired. However, he was freed of his worst symptoms, and in the course of six months found himself perfectly well, save for a hernia which developed in the operation scar. But his digestive organs now work properly, his mental state is good, and on the whole he has been benefited.

V. A further case was that of a man of twenty-eight, a farmer, sound, vigorous, and well nourished in appearance. For some five years his friends had noticed that his disposition was changing. Previously cheerful, active-minded, optimistic, he had become silent, retiring, morose. He never complained of ill health, but it was evident that he was suffering from a mental or physical ailment. Occasionally he would go all day

without food, and he was heard walking the floor at night.

In the summer of 1903 he consulted us and reluctantly stated that he had long suffered from a confirmed dyspepsia. He was constantly depressed and rendered miserable by trifles. His surroundings and daily companions had become irksome and intolerable to him, his food frequently distressed him, he was greatly troubled with eructations and constipation, and three days before he had spent a wakeful night from annoying general abdominal pain.

We had known the man for several years and recognized the mental condition which he described. A routine examination revealed nothing except a rather marked abdominal distention, until we came to the right iliac fossa, where on deep palpation we were able to detect an apparently swollen appendix, which was quite tender on pressure.

After watching the case for a couple of weeks, and finding always the tender appendix, we advised its removal. On opening the abdomen, nothing abnormal was discovered except an indurated appendix, slightly swollen and adherent throughout its length to the lateral aspect of the cæcum. The pathologist reported, "The appendix was seven centimetres long, of somewhat enlarged diameter, with many adhesions throughout its length; upon opening, the lumen was found to be obliterated at one end, dilated beyond, and containing thick glairy mucus; obliterating appendicitis."

Here again, as in nearly all these cases, the convalescence was uneventful. The patient was out of bed on the twelfth day and went home at the end of two

weeks. His dyspeptic symptoms disappeared, and the action of the bowels became normal. The most striking change was in his mental attitude. Two months after the operation he had regained his natural cheerfulness, and his friends reported that the "blues" had been banished.

VI. Another instructive case was that of a boy thirteen years old. Up to the age of eleven he had been a lively, vigorous child, but for two years he had been growing languid and timid. His appetite had become poor, his physical development had ceased, he had become very constipated and was frequently laid up in bed with severe attacks of what was thought to be "wind colic."

In this case a diagnosis was not very obvious, and it was only after studying him for several weeks and ruling out other suspected conditions that we decided to cut down upon the appendix. That organ was found quite normal in appearance, but adherent by its tip to the omentum. It was removed and the pathologist reported, "The appendix was three centimetres long, more or less injected, but otherwise not remarkable."

We were disappointed in these findings, but the results appeared to justify the operation. The lad rallied rather slowly, but continued to improve in general health and strength during the subsequent two years in which he was under our observation. He lost his lethargy, regained his appetite and vigor, was no longer constipated or subject to colics, and eagerly rejoined his comrades in their sports. To his parents the change was striking, and their satisfaction was proportionate.

Observe that the *pain* of chronic appendicitis may be

anywhere in the abdomen, but the *tenderness* is in the appendix.

These six cases are specially selected, of course, to show good results. One is not always so fortunate; but on the whole the conditions described are frequently met with by surgeons and must be very common in the experience of general practitioners.

These cases show a clinical course quite distinct from what is seen in "relapsing appendicitis," as it is properly enough designated. Probably many of the cases of relapsing appendicitis are truly acute exacerbations implanted upon chronic processes, but clinically the name is correct enough. The relapsing cases may be and often are very similar in their history to those chronic cases above described, except that there is always the story of definite and severe attacks of pain, with pyrexia, rapid pulse, obstipation, a rising leucocytosis, and tenderness on pressure; in other words, the clinical picture of an acute appendicitis. The process does not go on to an extensive involvement of the peritoneum; the symptoms subside, the local signs mostly disappear, and except for some impairment of the general health, the patient regards himself as well until he is again attacked.

Cases of both these classes are dangerous. At the best the disease may gradually destroy the appendix as a focus of infection and trouble, — a slow process, not to be counted upon; or the patient may expect to go on with the sword hanging over him, — never safe from day to day, while at the worst an acute attack may supervene at any time, with all the dread and danger which such attacks involve.

The treatment of chronic cases, always, is removal of the appendix. It must be so. That is a course safe and sure. All other methods, and such are zealously advocated especially by certain French writers, mean only procrastination, anxiety, and risk. We have yet to find the intelligent man who knowingly carries about with him a "grumbling" appendix, and does so complacently.

There are two good methods of reaching the appendix in the cases which are not acute, — by the McBurney incision, and by the "retromuscular route." In both, when all goes well and there are no complications, the wound is short — from two to three inches — and the resulting scar strong.

The familiar McBurney incision is made in the right inguinal region outside of the semilunar line. The skin having been cut, the underlying aponeuroses and muscles are split, not cut, until the peritoneum is reached and incised. As a result of this method of opening the abdomen, the various split structures fall into place again, immediately the restraining retractors are removed. Even without stitches, no hernia is likely to result. With stitches either "through and through," or placed in each layer, the wall is left as good as new. The McBurney method of incision is ingenious and valuable, and is the favorite of many operators of great experience. There are two objections to it, — one rather trivial, the other of importance at times. Except in the most practised hands, it is not a rapid method of entering the abdomen. When, for any reason, it is necessary to enlarge the McBurney incision after the abdomen has been opened, there results often a severe mutilation of

the abdominal wall with the consequent very considerable danger of hernia.

With many surgeons the retromuscular incision is the favorite. The skin incision is made over the middle of the right rectus muscle, below the umbilicus, and is carried down through the anterior sheath of the muscle. Then with a retractor the sheath is stretched outwards, the edge of the rectus is seized and drawn towards the median line, and the underlying peritoneum is opened immediately below the skin incision. So when it comes to closing the wound, the rectus muscle falls outward again past the peritoneal opening, previously stitched up, the anterior sheath of the muscle is united in its turn, and then the skin. A sound wall is the result, and in the very considerable experience of the writers no hernias have resulted. This method of entering the abdominal cavity is very rapid, but its great advantage is that the opening may be readily enlarged to any extent desired, and may be closed subsequently without change of technique and with a resulting scar exceedingly strong.

The treatment of the appendix stump in these chronic and "interval" cases has been a subject of much unnecessary controversy. It matters little how you treat the stump. One man cuts it off and invaginates it into the cæcum; another turns back a cuff of the serosa and stitches that over the stump by a purse-string drawn about it and through the serosa of the cæcum; while a third merely cauterizes the mucosa and leaves the stump to take care of itself. So far as we have gathered the results of these methods, all are equally good.

It would be interesting to learn the subsequent his-

tories of a large number of patients who have been operated upon for chronic and relapsing appendicitis. We have been at some pains to look up records of eighty such cases operated upon at the Massachusetts General Hospital and in our own practice, and have added to these twenty cases collected from the hospital records by F. T. Murphy. In brief it appears that of these one hundred cases the outcome may be expressed in the following table: —

	Perfect	Good	Bad
Anatomical Results . . .	94	4	2
Functional Results . . .	91	5	4

The "bad" results in these cases were due to adhesions either about the appendix stump or along the line of incision. In all of these four cases secondary operations were done with complete relief of symptoms, so that the patients are now well. The "good" results are cases in which there was no relief of digestive symptoms, or in which there were painful scars, and those last cases would be improved or cured probably by a second operation. There were no cases of hernia through the short incisions.

These results are extremely suggestive and encouraging. Probably few therapeutic measures undertaken for serious conditions in any department of medicine or surgery will make a better showing.

The question of functional results secured after operations for *chronic* appendicitis is interesting as bearing upon the question of etiology. Authors have been

wont to state that constipation and "indigestion" are among the prime causes of appendicitis. Lange,[1] for instance, regards the disease as very common in this country as compared with Europe, and states that this is due to our eating too fast and too much, with the result that we are a constipated people. Any one who has spent a few months in Germany or England may have observed that the peoples of those countries are trenchermen of no mean capacity, and comparative statistics as to national constipation remain to be compiled. Certain it is that of late years we hear almost as much of appendicitis in Europe as we hear of it in America. Now it is certain that in those cases in which constipation and "indigestion" are associated with appendicitis, the removal of the appendix commonly is found to be followed by a cessation of both forms of digestive disturbance.

Let us conclude, then, as we seem justified in doing, that in a great many cases of chronic dyspepsia, never permanently cured by medication or improved hygiene, an anatomical cause for the trouble is to be found in the appendix; and let us observe further that in more than 90 per cent of these cases appendectomy results in the restoration of health.

[1] Editorial in *Medical Record*, August 1891.

APPENDIX

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APPENDIX

DIAGNOSIS IN CONNECTION WITH SURGERY OF THE STOMACH

I. The Diagnosis and Significance of Gastrectasis.

II. The Diagnosis of Cancer and Ulcer of the Stomach.

III. Record of Clinical Findings in a Series of Cases of Stomach Disorder in which Pathological Diagnoses were made at Operation or Post-mortem Examinations.

Introduction

The general usefulness of surgery as a therapeutic measure in certain disorders of the stomach has entailed upon us an additional responsibility for the achievement of accuracy in the diagnosis of these disorders: first, because the possession of so useful a therapeutic remedy makes it imperative that all cases which are amenable should get the benefit of the remedy, and at the earliest possible opportunity; and second, because the employment of this surgical remedy, in all conditions, at the most optimistic estimate, being associated with some danger, it is imperative that the greatest accuracy possible in the understanding of the conditions present should be attained before subjecting the patient to this danger.

A full knowledge of the method and means of diagnosis of these special conditions of stomach disease amenable to surgical treatment which are at present at our disposal is, therefore, an essential part of the equipment of all medical men, as well of the surgeon who operates upon the cases as of the physician who first sees them.

The facts or clinical data upon which diagnosis is based in these conditions of stomach disorder may be divided into three groups, according to the method of examination by which they are obtained.

They are, *first*, the facts of the history and subjective symptomology of the patient; *second*, the findings by ordinary physical examination, — inspection, percussion, and palpation of the abdomen, — and study of the general physical condition of the body, the existence of emaciation, cachexia, or anæmia, for example; and *third*, the findings obtained by the application of special objective methods of diagnosis, — as the examination of the contents expressed by the use of the stomach tube for the study of the chemistry or motor function of the organ, the study of the size and location of the stomach as examined by inflation with air, the study of the fæces for evidence of bleeding in the stomach.

With the subject-matter of the first two groups, — the details of the history and regular physical examination of stomach disorders, — the average practitioner is conversant. He can read it in the text-books, and he observes it in his cases.

With the matter of the third group, — the special methods of investigation of the stomach, the findings which can be obtained by them, and the insight to the understanding of the various stomach disorders which may be achieved through the use of these methods, — the acquaintance of practitioners, even of those of widest experience and advanced knowledge, is much less intimate.

Yet not only are these special examinations a necessary part of the study of all cases of stomach disorder, but it is from the results of these examinations, in the majority of stomach cases, that the most definite determination in regard to the nature of the disorder present is made.

I have, during the last ten years, been making a special study of these expert methods of diagnosis of stomach dis-

eases, and have collected in this article a brief summary of the results of my experience in regard to the value of the various findings obtained by these methods, and of the usefulness of the routine utilization of these methods in the clinic for the diagnosis of the special forms of stomach disorder which have, up to the present, proved a suitable subject for surgical treatment.

The disorders of the stomach to the relief and cure of which surgery lends itself are : —

(*a*) Conditions of insufficient drainage of a *chronic* character, from any cause.

(*b*) Cancer of the stomach.

(*c*) Ulcer of the stomach.

Chapter I. — The Determination and Significance of Insufficient Drainage, or Gastrectasis

Insufficient drainage of the stomach exists as a condition secondary to a variety of causes. Omitting the conditions of acute retention, such as occur in acute gastritis or spastic stenosis, insufficient drainage means, in the great majority of cases, an obstruction of the pyloric opening, from cancer, or ulcer, or adhesions, or other cause, or a dilatation of the stomach or ptosis of the organ with atony of the walls. A few cases have been reported in which the phenomenon represented local stagnation in a part of a stomach, — cases of hour-glass stomach; or cases of cancer of the wall, where bacterial elements were harbored in the surfaces of the neoplasm for undue periods, the *general motility* of the organ being normal.[1]

The degree of the mechanical disturbance and the resulting evidences of the condition of stasis vary with the case. In cases in which the only retention is that caused by the rough surfaces of a neoplasm of the wall, the stomach may, to all appearances, empty itself in a normal period, the only

[1] Strauss, *Zeitschr. f. klin. Med.*, Vols. XXVI and XXVII; *Deutsch. Med. Woch.*, 1896, No. 38, supplement.

evidence of insufficient drainage being the presence in the contents of the stomach of an excessive number of organized ferments, with the capacity to cause excessive fermentation. The only evidence of stasis in such conditions is the finding of one of the fermentation tests (see pp. 355–356). In cases in which the general motility is reduced, we have, together with this excess of ferment capacity, or sometimes without this element, a retention of the ingested food for periods longer than normal. This retention of food may be slight, when a meal, — a Leube meal, for example, — which should be entirely emptied from the stomach seven hours after ingestion, takes eight to ten hours for the process of evacuation. Or the retention may be marked in degree, in which case food contents will be found twelve hours or more after feeding.[2]

Whatever the type and degree of stasis, it can always be diagnosticated when it exists by obtaining the stomach contents at a period when, if conditions of drainage are normal, the stomach should contain no macroscopic food elements or show signs of excessive ferment population.

The standard period adopted for this test in my investigation was one at least twelve hours after the ingestion of the food or material of any kind. As the average time of the stomach for emptying itself after a full meal, a Leube dinner, is seven hours,[2] this twelve-hour period is long enough beyond the normal limit to allow for normal variation and idiosyncrasy and to show an undoubted disturbance of motor capacity. Slight conditions of stasis which may be overlooked by this method may be discovered by further experiments at eight-, nine-, or ten-hour periods. For a standard period for the initial examination in ordinary practice, however, that of twelve hours is the most satisfactory.

The stomach contents, obtained by expression with the tube at this twelve-hour period, are called the *contents of the fasting stomach.*[3]

[2] Leube, *Deutsch. klin. Med.*, Vol. XXXIII.

[3] It is the rule, even with normal individuals, to obtain some contents

To determine the existence or non-existence of insufficient drainage (or as it is called in clinical terminology, gastrectasis), the contents of the fasting stomach should be examined for the presence of two elements: (1) an abnormal food residue, which means the presence of food microscopically recognizable or of a sediment which under the microscope turns out to be made up of masses of food; (2) an abnormal ferment contents. If the case is one of stasis, one or both of these will be present.

The first factor, the abnormal food residue, is the more constant. It was present in twenty out of twenty-one stasis cases of my clinic.

The fasting contents of the normal stomach, as studied in twenty cases, showed no food elements other than an *occasional* starch granule or small fragment recognizable under the microscope.

Where a food residue is present, no further search for evidence of stasis is necessary. If such food residue is absent, the contents must be examined for the presence of the other stasis factor, an abnormal ferment content.

The presence of such a ferment content in the fasting contents may be discovered, (1) by the finding of numbers of the organisms known as *sarcinæ ventriculi;* (2) by finding lactic acid; (3) by finding an excessive yeast fermentation capacity in the contents. If any one of these tests is positive, the existence of stasis, *i.e.* of insufficient drainage, is proven. If all, in addition to the food test, are negative, the condition — that is, a twelve-hour stasis — is absent.

The sarcinæ are recognized by examination of the sediment under the microscope. They are but an occasional feature of stasis, occurring, as a rule, in association with a plentiful HCl secretion.

The sarcinæ do not occur in considerable numbers in any condition other than stasis.[4]

in a stomach twelve hours after a meal, say 5 cubic centimetres to 30 cubic centimetres.

[4] Oppler, *München Med. Woch.*, 1894, No. 29.

Lactic acid is discovered by the following test: To 5 to 10 c.c. of stomach contents add a drop of HCl, boil to a syrup, extract the syrup with 5 to 10 c.c. of ether. Add the ether extract to a practically colorless solution of ferric chloride. A resulting greenish yellow color shows the presence of lactic acid.

Lactic acid occurs only in those conditions of stasis in which the secretion of HCl is reduced. It is not found *in the fasting contents*, whatever the disease, unless stagnation is present (*vide* Notes 18 and 19, pp. 372–373).

This lactic acid test for stasis is of diagnostic value *only* when it is found in a fasting contents. Here it matters not whether the quantity is influenced by the nature of the food taken, its content of lactic acid or lactates, or is due entirely to fermentation. If present, it means stasis. The presence of lactic acid in vomitus, or in contents other than a fasting contents, cannot be given such significance unless it can be proven that no appreciable amount of lactates or of the acid (sarco-lactic acid) was present in the food of the patient.

The third stasis factor, the presence of yeast fermentation, is tested for as follows: —

Ten or twenty cubic centimetres of contents (according to the quantity obtained) is mixed with one-half its quantity of sterilized 10 per cent glucose solution. This mixture is placed in a fermentation tube, absolutely filling the tube, and is placed in a thermostat at 37° to 40° C.

Any apparatus for determining fermentation may be used in the test. I have used a test-tube of a capacity of 20 c.c., in which was inserted a rubber stopper carrying a bent glass tube which reached to within one inch of the bottom of the test-tube. The quantity of fermentation can be judged, in such an apparatus, by the amount of the mixture in the tube displaced by the gas formed in the fermentation process.

In performing the experiment the mixture should first be observed, if possible, twelve hours after the beginning of the experiment; then at eighteen hours, twenty-four hours, and

forty-eight hours, and the presence of fermentation, as evidenced by the quantity of gas formation, should be noted at each observation. If no gas formation, or one of very slight extent (say one-twentieth of a tube at most), is present after forty-eight hours, the result of the test may be regarded as negative. If a gas formation of more than one-twentieth of a tube is present, the sediment of the fermentation mixture must be looked at under the microscope. If this sediment contains a numerous colony of freshly budding yeast spores, the result of the test may be regarded as positive, and so the evidence of stasis is confirmed.

The contents from a normal stomach or from a stomach affected with disease, but with no interference with the emptying of the contents into the duodenum, have in no case, in my experience of over one hundred and eighty contents studied by this method, given a positive fermentation test according to the above standard. We do, in cases other than those of stasis, sometimes get by this test a *gas formation* of varying amounts up to three-fourths of a tube in forty-eight hours. In fact, in fasting contents which contain no free HCl, it is the rule to get a certain amount of gas formation. But in all these cases, excepting those in which stasis is present, the sediment is made up of bacteria, not of yeast. In such cases, the bacteria swallowed from the mouth are apparently sufficient to cause some fermentation. This does not occur with yeast, however, except to the extent of the formation of a few bubbles at the top of the test-tube, unless stasis exists. I have obtained the bacterial fermentation with gas fermentation *in vitro* with the contents from normal individuals.

The phenomenon of excessive yeast fermentation may, according to my records, occur in any contents of a stomach with stasis, both in those stomachs with a low acid secretion, when it is associated with an active bacterial fermentation, or in those with much free HCl. Case VII of my record gave both this yeast test and the lactic acid test for bacterial

fermentation. The yeast is more characteristic, however, of cases in which a combination of *stasis with plenty of free HCl* is present, — cases in which bacterial fermentation is not a feature. I have seen it in cases in which the quantity of free HCl was .20 per cent, — that is, hyperchlorhydria (see Cases V and XXIII).

The yeast fermentation test has, like the sarcinæ test, one special value, — it can be applied to a contents obtained at any time. It may, therefore, be possible sometimes to diagnosticate stasis by the use of this test, in emergency cases, as, for example, where a vomitus only is obtained or where it is difficult to arrange for obtaining the fasting contents without recourse to the more elaborate preparations necessary for obtaining the fasting contents. It must be borne in mind, however, that this yeast test, like the sarcinæ test, is not positive in all casis of stasis. In some cases, for example, the fermentation is entirely of the bacterial type, the test for which is the lactic acid test in fasting contents. So that the fermentation test must not be used for ruling out stasis, though it may always be used for ruling it in.

These tests for ferment elements are *supplementary* tests, for use on occasions when, as a rush measure, or through inability to obtain fasting contents, examination is made on contents after a meal, or from vomitus ; or in cases in which, upon examination of fasting contents, the regular test, the food residue, is lacking.

This first use of these supplementary tests depends upon the fact that two of these tests, the sarcinæ and the yeast ferment tests, can be determined in vomitus or contents after a meal, as well as in a fasting stomach. This is not always true of the regular food test, which in many cases of stasis is undeterminable in contents obtained within six hours after a meal. We may, therefore, by the use of the sarcinæ or yeast test, be able to make our diagnosis of stasis without recourse to the fasting contents. It must be borne in mind, however, that these two special tests or evidences,

the sarcinæ and yeast tests, are not positive in all cases of stasis, and that, therefore, their absence cannot be used to rule out stasis. Such exclusion can be done only by examination of fasting contents.

The second use of these supplementary tests, their use when a food residue is lacking, is to be employed on the chance that by this means we may discover occasionally some obscure condition of stasis when the regular test is lacking. Such, for example, as local retention of ferments in the surface of a neoplasm (Note 1). I have so far in my work found two cases by this extra method of applying the yeast test to fasting contents, when the food test failed. Although these cases are few, the fact is important, and the presence of this measure as a routine may result in the occasional making of an early diagnosis of some such serious condition as cancer or ulcer.

Such is the method for the determination of the existence or non-existence of stasis which my study of stomach conditions has led me to adopt as a routine method in clinical work.

I do not mean to imply that it is the only method of diagnosticating stasis, but simply that it is the best and most accurate one, for all cases, which I have found. Stasis may, for example, be diagnosticated in some cases by examination of the contents obtained at any time, or from the vomitus, without recourse to the examination of fasting contents. If it is so diagnosticated by the finding, for example, of sarcinæ or of food taken on previous days, there is, of course, no necessity of further examination. A positive yeast fermentation test in vomitus or digesting contents has the same significance. Cases of stasis are not infrequent, however, in which the diagnoses can be determined by the examination of the fasting contents only. And the possibility of stasis can never be ruled out without such an examination.

Whether this method can be relied upon in all cases, is a matter which can be decided only by practical experience.

In my experience, results based upon this method have so far proved correct, both as regards positive and negative findings, in every instance in which it has been possible to verify the evidence of clinical findings by a determination of the actual anatomical conditions with which they were associated, — that is, when it has been possible to test the results by a scientific method. In support of this statement, I have collected in a separate list the records of all my cases examined by this method, in which cases, as a result of operation or of post mortem, it was possible to determine the actual anatomical or pathological conditions present. In such a record we have an experimental test of scientific value in regard to the value of our clinical findings and of the deductions which can be drawn from them in regard to diagnosis of the actual conditions present. And by such a test the real value of our method of clinical procedure is determined.

A summary of the records of these cases is as follows: Among one hundred and eighty cases included in my investigation, thirty-nine came to surgical operation or post-mortem examination. Of these thirty-nine cases, the test cases of our experiment, in twenty-one there had been a clinical diagnosis of stasis. In these twenty-one cases of "clinical stasis" an "anatomical finding" of obstruction of the pylorus — that is, of an actual anatomical cause for stasis — was found in every case.

The actual pathological findings in these twenty-one stasis or obstruction cases were: —

Cancer at the pylorus, ten cases.

Ulcer at the pylorus, ten cases.

Adhesions about the pylorus, one case.

In the eighteen clinical no-stasis cases, the pylorus was found to be intact or patent in every case. The actual pathological findings present in these no-stasis cases were: —

Cancer of the stomach, ten cases.

Ulcer of the stomach, three cases.

Chronic gastritis, two cases.

No demonstrable lesion of the stomach, three cases.

That is, in the thirty-nine cases in which it was possible to obtain an actual test of the accuracy of our clinical diagnosis of gastrectasis, the clinical diagnosis was confirmed by the anatomical finding in every case.

The testimony of this experimental record is, therefore, unanimous in favor of the accuracy of the clinical method employed. From it we may deduce three conclusions of importance in the clinical study of stomach conditions: —

1. The existence of stasis in a given case can always be diagnosticated by a proper method of investigation.

2. The clinical sign of a twelve-hour stasis as a constant feature of a case is always a sign of a serious condition (Note 5, page 362).

3. Stasis is not, as a rule, an associate of even the serious stomach conditions, cancer or ulcer, unless the lesion is situated in the region of the pylorus.

Chapter II. — The Diagnosis of the Conditions of Cancer and Ulcer of the Stomach

The diagnosis of cancer and ulcer of the stomach, if we are to consider all cases, the early and the late, is far from being on the absolute and simple basis that could be desired or that is present in the consideration of insufficient drainage. In some cases, — ulcer with acute hemorrhage, or carcinoma with a palpable tumor, — the diagnosis is simple. On the other hand, in many cases of both ulcer and cancer, especially in early stages, accurate diagnosis is difficult.

A careful and long-continued study of these conditions has convinced me that it is possible, by a combination of a careful study of symptoms and the record of the findings obtained by the application of objective methods of diagnosis, to arrive at a *probable*, if not an absolute, diagnosis of either of these two conditions in a high per cent of the cases

in which they exist, a much higher per cent than is generally recognized.

The objective findings determined by the use of the special methods of stomach examination which experience has demonstrated to be useful in connection with the special diagnosis of ulcer or cancer of the stomach are : —

(1) The finding of chronic stasis in the stomach.

(2) The finding of evidence of bleeding in the stomach.

(3) The finding or the failing to find free hydrochloric acid, or lactic acid, in the stomach contents.

(4) The finding of abnormal elements in the sediment, — fragments of cancer, pus, or numerous or special forms of low organisms, as sarcinæ, bacteria, or yeast fungi.

(5) The finding of the size and location of the stomach, ascertained by inflation of the organ.

The importance of stasis as a sign of ulcer or cancer lies in the fact that, since the commonest cause of insufficient drainage is obstruction of the pylorus from ulcer or cancer, the presence of stasis is always one suggestion of the presence of ulcer or cancer in the case.[5] The stasis may be due to such other chronic affections as atonic dilatation, ptosis, or obstructions from the adhesions, hence its existence is not pathognomonic of the lesions in question. But the more we study the pathology of chronic stasis, the more frequently do we find an old cicatrix or a neoplasm, so that we are coming to recognize the rarity of simple dilatation as a cause of stasis, — that is, of twelve-hour stasis.

How frequently ulcer or cancer at the pylorus *may* be the cause of stasis in a series of cases can be judged from my own records. In my list there are twenty-one cases of stasis which came to operation or to post mortem. The cause of the stasis was found to be *ulcer* at the pylorus in ten, *cancer* at the pylorus in ten, and *adhesions* about the

[5] It is understood that I am speaking here of chronic stasis. Temporary conditions of stasis, such as occur in acute affections, in acute gastritis, or acute spastic stenosis, are to be excluded.

pylorus in one. Diagnoses were made in all these cases by the method of examination of the fasting contents which I have described. That is to say, all were cases of twelve-hour stasis.

This frequency of ulcer or cancer as a cause of stasis is probably exceptional. There happened to be no cases of simple atonic dilatation in this series. Yet my records represent a set of unselected cases, operation having been advised in all instances in the clinic where chronic stasis was found, excepting, of course, cases of inoperable cancer.

From such results we are justified in saying that the finding of stasis in any case of stomach disorder is in itself suggestive of the presence of ulcer or cancer at the pylorus. When this sign — stasis — is taken in connection with other findings, such as the abnormal size and location of the stomach, blood in the stomach, an anæmic condition of the patient, etc., it frequently confirms the diagnosis of cancer or ulcer. Also the finding of stasis *which has a food residue as its sign*, in connection with cancer or ulcer, indicates that the pylorus is the seat of the lesion.

The absence of stasis has no bearing on the question of the existence of ulcer or cancer in the stomach except that its absence is an argument against the presence of either of these lesions at the pylorus.

According to my experience cancer or ulcer elsewhere than at or near the pylorus apparently has no influence of a permanent character on the general motor capacity of the stomach, or at all events no such influence as would cause retention of food for twelve hours.[6] Thus among the eighteen cases of stomach disorder showing no-stasis in my

[6] That a neoplasm situated elsewhere than at the pylorus may cause a local retention of ferment organisms, as bacteria and yeast, and thus give a sign of insufficient drainage in a lactic acid or yeast test, without any general affection of motor function as evidenced by a food residue, is proven by the observations of Strauss (see p. 353, Note 1).

series which came to operation, there were three cases of ulcer and ten cases of cancer.

The second objective finding which is of special value in connection with the diagnosis of cancer or ulcer is the finding of bleeding in the stomach. Bleeding in the stomach may occur, according to the results of research upon the subject at present in our possession, as an associate of the following gastric diseases, tabulated in the order of its frequency: cancer, stenosing gastritis from any causes, ulcer, acute gastritis from certain irritants, among them alcohol (Ewald), acute spastic pyloric stenosis, polyposus ventriculi (Clemm), gastric erosion (Einhorn). (See small type, p. 368.) Bleeding does not occur in chronic gastritis of either the hypoacid or hyperacid type, in nervous affections, hyperchlorhydria, or simple hypersecretion, or in simple ectasia. (See small type, p. 369.) Of the conditions in which bleeding may be found, the last two, polyposus and erosion, are very rare, — too rare to count statistically in a differential diagnosis based on the blood finding alone. For purposes of differential diagnosis we have, therefore, to consider, in any case of stomach disorder when bleeding in the stomach is proven, either (1) some acute affection, or (2) one of three chronic affections. Acute affections can be ruled in or ruled out by proper study of the case. If an acute condition is absent, the bleeding indicates one of the three chronic conditions, — cancer, or ulcer, or stenosing gastritis.

From this summary of our knowledge on the subject it appears that the finding of bleeding in the stomach, in the course of the clinical examination, if we are dealing with a chronic condition, indicates the existence of a serious stomach affection, either cancer or ulcer, or stenosis of the pylorus from some cause (stenosing gastritis). And since, as I have already shown, the third condition, stenosis, with its secondary gastritis, is in the great majority of cases due to cancer or ulcer, the blood finding in the great

majority of cases means one of these two affections, cancer or ulcer.[7]

This is the clinical significance of a blood finding in either the gastric contents or the fæces, which is proven, by the use of a proper method of research, to have as its cause a disease of the stomach.

The methods of determining the existence of bleeding in the stomach are two in number : (1) the examination of the stomach contents, (2) the examination of the fæces.

Blood may appear in the fasting contents either as fresh blood or clots, recognizable to the eye, or as a dark sediment of changed blood (coffee grounds), or it may be so thoroughly mixed with the contents as to give them no color or abnormal character, the so-called "occult bleeding."[8]

The presence of fresh blood is determined by inspection.

The presence of changed blood (coffee grounds) or of blood in solution ("occult bleeding") is determined by the chemical test.

The best blood test for practical work is the guaiac test of Van Deen, modified by Weber.[9] It is performed as follows :—

Five to ten cubic centimetres of the stomach contents are acidified with one-third their quantity of glacial acetic acid and the mixture is shaken with 5 c.c. of ether. One to 2 c.c. of the ether extract is then drained off and added to an equal quantity of a *freshly made* alcoholic solution of gum guaiac. To this mixture a little hydrogen peroxide, or twenty drops of old oil of turpentine, are added, and if blood be present, a deep blue color soon appears. The guaiac solution should be made from the yellow parts of the gum,

[7] Boas states that blood is present in the fæces in practically all cases of stenosis with secondary gastritis. In the stomach contents no such constancy is found. Thus my records show four cases of stenosis from cancer and four from ulcer cicatrix, which gave no blood finding.

[8] Boas, *Deutsch. Med. Woch.*, 1901, No. 20, S. 315.

[9] Weber, *Bert. klin. Woch.*, 1893, No. 19.

and should be tested with the peroxide before using.[10] The addition of water and chloroform after the above procedure increases the delicacy of the test.

Before concluding that blood in stomach contents is evidence of bleeding from stomach disease, we must first, by a proper method, exclude (1) all outside sources of bleeding, as the mouth, or throat, or lungs ;[11] (2) bleeding from the mouth, or œsophagus, or stomach, from irritation by the tube ;[12] (3) the presence of blood-containing substances, as uncooked meat ;[13] (4) the presence of certain general diseases which may cause bleeding into the stomach, such diseases as cirrhoses of the liver, purpuric diseases, pernicious anæmia, gall-stones, jaundice, and tubercular peritonitis in infants. If we can exclude these possible sources for blood, as well as acute stomach affections, a blood finding in the fasting or digestion contents, as obtained by tube, means, in the great majority of cases, cancer or ulcer. When stasis is absent in such a condition, we must conclude that, barring the very rare chronic conditions cited, cancer or ulcer is present, — for stenosing gastritis, the third possibility, is always associated with stasis.

In the investigation of this subject, I have, during the last

[10] The criticism of the original guaiac test, that it reacted to substances other than blood, does not apply to this modified test, as the ether does not take up these substances. After all, no better evidence of its accuracy is needed than that offered by my experience of its routine use in stomach cases, with negative results in all save those of cancer and ulcer.

[11] Joachim found no blood test in the fæces of cases of phthisis or pneumonia. Such cases might, however, give a chemical blood finding in the gastric contents. (Joachim, 15 *b*.)

[12] Blood caused by the passage of the tube is fresh blood, and, as a rule, appears in part floating in mucus or saliva. The use of a very soft stomach tube, with a closed, rounded end, will lessen the chance of artificial production of blood.

[13] Joachim (*loc. cit.*) found that cooked meat, ingested by mouth, gave no blood test in the fæces. Uncooked meat gave a positive test. (See also Hartmann, Note 15 *d*.)

six months, made a routine examination of the blood in the fasting contents of all stomach cases which have come under my care. All together, one hundred and sixty cases of various forms of stomach disorder were examined. The tests used were, first, inspection for fresh blood, and second, the guaiac test. The results of this blood investigation are as follows : —

Excluding all cases in which blood might be thought due to irritation of the tube (that is, all cases in which small amounts of fresh blood were found after the use of the tube, and yet examination of fæces at other times showed no blood, and all conditions of acute stomach disorder), a blood finding was present in twenty-two cases. All of these twenty-two cases, save one, have come to operation or post-mortem examination. The pathological findings in them were : cancer of the stomach in fifteen, ulcer in six. One case diagnosticated as cancer was not operated upon and was lost to sight. That is, omitting the one case which was not proven, in an examination of one hundred and sixty cases of stomach disorder, a positive, or, more properly speaking, a significant, blood finding was present in none of the *chronic* cases, excepting those which were later proven by pathological examination to be conditions of cancer or ulcer of the stomach.

Such a record is significant in connection with the question of the importance of the blood finding in the stomach contents as an aid to diagnosis. The list of cases with negative blood findings by clinical diagnosis includes chronic gastritis, nervous affections, hyperchlorhydria, hypersecretion.

Cases with a negative finding, in which a pathological diagnosis was obtained, were : cancer, five cases ; ulcer, five cases ; obstruction from adhesions, one case ; chronic gastritis, two cases ; neurosis, two cases.

Of eighteen cases of stenosis from all causes, blood was found in nine.

Search for blood in the fæces is conducted in the following manner : —

A portion of fæces is mixed with water — acetic acid is then added and the mixture shaken with ether ; emulsion should be overcome by the addition of alcohol. The ether extract is then added to a freshly made solution of the guaiac-in-alcohol and peroxide of hydrogen or old oil of turpentine.[14]

According to extensive observation with this method of research blood tests are not found in the fæces save in some special disease of the alimentary tract or of the organs entering it. The test is negative in the ordinary conditions of diarrhœa (Joachim, Schloss, *loc. cit.*). Its positive value is attested by the fact that three grammes of blood introduced into the mouth may be removed by this test in the fæces (Joachim).

This method of examining the stools for evidence of bleeding in the stomach has the difficulty that all other sources of bleeding in the course of the alimentary tract have to be considered and excluded before a diagnosis of stomach bleeding can be made positively. The method is, therefore, inferior to the examination of the stomach contents. Negatively, however, it is of greater value. In spite of the chances for error, the method is of value in connection with the study of cases of stomach disease.

This value may be summarized as follows : —

1. A positive finding by the method may offer evidence or additional evidence of the existence of cancer or ulcer of the stomach.

2. A negative finding on several repetitions offers evidence against the existence of cancer (*vide* small type below).

The subject of the occurrence of bleeding in various forms of stomach disorder has been carefully investigated by numerous observers, both by the examination of the gastric contents and of

[14] For special modifications and precautions in connection with this test, *vide* Clemm, note 15 *c*.

the fæces. The mass of the results on which our knowledge is based was obtained by study of the fæces.[15]

According to these results bleeding is practically a constant associate of the following stomach diseases: cancer, stenosing gastritis, polyposis ventriculi. Einhorn (*Journal American Medical Association*, May 2, 1899) records cases of a condition known as gastric erosion in which a blood finding in the stomach contents is a feature. This condition must, therefore, be added to the above list. Boas found blood in repeated examinations in the fæces of sixty-five out of sixty-seven cases of cancer of the stomach.[15a] Joachim found blood in twenty out of twenty-one cases.[15b]

Blood is common but intermittent in appearance in ulcer. Joachim found it at times in the fæces in twenty-three out of twenty-eight cases of ulcer. It may occur in acute gastritis from alcohol (Ewald), or from other causes, and from acute consecutive spastic pyloric stenosis. It is never found in nervous affections or simple ectasis. It is very rarely, if ever, found in chronic gastritis, according to extended observations of Boas, Schloss, Joachim, Clemm (*loc. cit.*). Kuttner's opinion that blood does occur in this affection (Kuttner, *Zeit. für klin. Med.*, Bd. 45) appears to be overruled by weight of testimony.

The study of the acids of stomach contents has value in connection with the diagnosis of cancer and ulcer.

The chief points of this acid analysis which may have importance in this connection are (1) the presence and quantity of free hydrochloric acid, and (2) the presence of lactic acid.

It has long been recognized that a diminution in the secre-

[15] *a.* Boas, "Uber occulte Magen Blutengen," *Deutsch. med. Wochenschrift*, No. 20, 1901. "Uber d. Diagnosis d. Ulcus Ventriculi," *Deutsch. Med. Woch.*, No. 47, 1903. "Beiträge zur Kenntniss der Magen carcinoma Bluten," *Archiv. f. Verdauungs-Krankheiten*, Bd. vii, 3413. Kochman, *Archiv. f. Verdauungs-Krankheiten*, Bd. viii, S. 545.

b. Joachim, *Berl. klin. Woch.*, 1904, xii, S. 466. Schloss, *Archiv. f. Verdauungs-Krankheiten*, Bd. x, H. 3, S. 257.

c. Clemm, *Archiv. f. Verdauungs-Krankheiten*, Bd. x, H. 4, S. 373.

d. Hartmann, *Archiv. f. Verdauungs-Krankheiten*, Bd. x, No. 1, S. 48. Schmiliusky, *München med. Woch.*, 1903, No. 49.

tion of the hydrochloric acid of the gastric juice is a common associate of cancer of the stomach. And although exceptions to this rule are not uncommon, it may definitely be stated that such a diminution, when determined by an absence of free HCl *in the digestive contents obtained one hour after an Ewald test meal*,[16] is the rule in cases of cancer of the stomach, as we see them in practice; that is, at the late stage of development when diagnosis of cancer is commonly made. So an absence of free HCl has a certain importance in connection with the diagnosis of cancer. This importance, however, is limited, owing to two facts: *first*, an absence of free HCl is sometimes an associate of conditions other than cancer;[17] *second*, it is not uncommon to find free HCl in well-developed cases of cancer (see Cases No. IV, XXXVII, in my table). In fact, absence of free HCl is probably only a late symptom of cancer in a great majority of cases.

These points are well illustrated in my records. Of one hundred and sixty cases, free HCl was absent, both in the fasting contents and after the test meal, in nineteen. Of these, fifteen were cases of cancer, all seen at operation or post mortem. The others were not operated upon.

[16] The question of the presence or absence or of the quantity of free HCl is best determined in a contents obtained after a test meal, for example a contents expressed one hour after an Ewald breakfast. Absence of free HCl in a fasting contents may occur in normal individuals (see records in "The Diagnosis of Gastrectasis," *Boston Medical and Surgical Journal*), or in conditions of disease when a plentiful supply is present under the stimulation of food (see Cases III, VIII, XXIV, XXXIV, in table). The presence of free HCl in a fasting contents is sufficient evidence of the presence of a secretion and obviates the necessity of the test-meal estimate, save to estimate relative insufficiency (Gluyinski).

[17] In a research made in 1899 upon stomach disorders I found the absence of free HCl a characteristic of twenty-four cases, none of which at the time showed any special evidence of cancer. I have records of sixteen of these cases up to date, and no one of these has developed any further evidence of cancer in the interval. *Boston Medical and Surgical Journal*, May 17, 1900.

Among twenty cases of cancer (pathological diagnosis) free HCl was absent in fifteen, both in the fasting and digesting contents; HCl was present in the contents (test-meal contents) in five. Of these five cases, four were located at the pylorus and one was on the lower wall of the stomach (an early case without metastasis); two of these cancers of the pylorus were developed upon former ulcer cicatrices; three of the HCl cases were advanced, and showed metastases.

It appears from this summary that some, but a very limited, value can be placed on the estimation of free HCl as an aid in the diagnosis of cancer. In this connection we can say, merely, that, given signs of a serious stomach trouble, stasis, or blood, or other symptoms, the absence of free HCl, after a test meal, is a point in favor of cancer, but that the presence of HCl by no means rules out that condition.

Ulcer of the stomach, as a rule, is associated with a plentiful secretion of HCl, — in fact, an excessive secretion, hyperchlorhydria, is a common associate of ulcer. Cases of ulcer with no free HCl have been reported (*vide* Bial, *Berl. klin. Woch.*, 1895, No. 6). They are very rare, however. My records show the following findings on this subject: —

Of ten cases of ulcer (pathological diagnosis), free HCl was present, both in the fasting and the test-meal contents, in all. The quantity of free HCl (after the Ewald meal) was normal, below 0.14 per cent, in four; high (over 0.15 per cent) in six; excessive (over 0.2 per cent) in four.

As between ulcer and cancer, therefore, we can say, merely: (1) an absence of HCl favors the latter; (2) presence of HCl may go with either, though more common in ulcer; (3) excess of HCl suggests ulcer.

Lactic acid, when present in the contents of the stomach twelve hours after a meal (the so-called fasting contents), is an indication of stasis or stagnation. Lactic acid is in such

cases, in part at least, the product of abnormal bacterial fermentation in the stomach, for the development of which stasis offers an opportunity. This lactic fermentation does not occur in all conditions of stasis, but only in those in which the secretion of hydrochloric acid is diminished, — cases in which the contents contain no free HCl or small quantities of the acid.[18b]

This combination of stasis and diminished HCl secretion is much more common in cancer than in other conditions. Therefore lactic acid is more common in association with cancer than with other diseases. It may, however, occur when stagnation is due to other conditions.[18c] *It does not occur in cancer unassociated with stasis.*[18a]

These facts in regard to lactic acid are well illustrated by my cases.

In one hundred and sixty cases lactic acid was present in the *fasting contents* in seven. These were all cases of cancer

[18b] Lactic acid fermentation does not occur in the presence of an acidity of .12% total HCl (not free HCl). Strauss, *Zeit. f. klin. Med.*, Vol. XXVIII. Lactic acid, though the rule in cases of stasis associated with diminution of HCl, is for some unexplained reason not always present in such cases. Boas, *Zeit. f. klin. Med.*, Vol. XXV, Nos. 3 and 4.

[18c] Lactic acid may be present in conditions other than cancer provided that stagnation associated with diminution of HCl secretion is present. Bial, *Berl. klin. Woch.*, 1895, No. 6, reports a case of ulcer at the pylorus where HCl was absent and lactic acid present. Rosenheim, *Deutsch. Med. Woch.*, 1895, No. 15, reports similar cases.

[18a] Stagnation of some kind is essential for lactic acid formation by fermentation in the stomach. As a rule the presence of the acid in the fasting contents means actual motor insufficiency — most commonly stenosis from cancer. It may occur, however, where the general motor function is preserved but where a stagnation of bacteria is accomplished through the harboring of these organisms in the folds or rough surfaces of a neoplasm. Strauss, *Zeit. f. klin. Med.*, Vols. XXVI, XXVII, reports such cases — all cases of cancer. It does not occur in all cases of cancer, however, as demonstrated by my records (*vide* also Klemperer, *Deutsch. Med. Woch.*, 1895, No. 14), but only if the cancer happens to cause stagnation either by stenosis or by its rough surfaces. Lactic acid bacilli are always present in the mouth (Miller).

at the pylorus, and showed the combination of stasis and absence of free HCl. Among twenty cases of cancer, lactic acid was absent in thirteen, including three cases of cancer at the pylorus, with plentiful secretion of HCl, and ten cases of cancer unassociated with stenosis. Lactic acid was absent in all cases of stasis in which HCl was present in the fasting contents, the cases of stenosis from ulcer or adhesions. It was absent in all cases unassociated with free HCl in which stasis was not an associate.

Lactic acid should be looked for in the fasting contents. In contents after a meal it may be present as ingested acid or as a production from the lactates of the food, and so be without pathological significance. The test for lactic acid, to be employed in clinical work, is the modified Uffleman test given on p. 256.[19]

The study of the sediment of the contents or washings from the stomach may give valuable information as to the diagnosis of ulcer or cancer.

In some cases fragments of tissue, which when hardened and examined in section proved to be cancer, have been found. Such a finding is, of course, pathognomonic.[20]

The finding of isolated cells resembling cancer cells may be suggestive, but in my experience diagnosis by such finding is uncertain. I have known several mistaken diagnoses which have been made in this way.

The finding of a sediment of pus alone, in the fasting contents, is said by some observers to be suggestive of cancer.[21] I have made this finding in two cases. One proved to be cancer. (See Case XIII.) The other was not operated upon.

[19] De Jong, *Archiv f. Verdauungs Krankheiten*, Bd. 11, H. 1, S. 59. Records in regard to lactic acid are of doubtful value unless obtained by such an accurate method of testing, or by Boas's test. The regular Uffleman test without the addition of HCl and solution in ether cannot be depended upon.

[20] Hemmeter, "Diseases of the Stomach," p. 526.

[21] Strauss, *Berl. klin. Woch.*, 1899, No. 40.

A study of the bacteriology or of the lower organisms of the sediment often is of value, particularly in connection with other findings. As already stated, bacteria are present in all stomach contents. In my experience, they are few in number in contents containing free HCl, whether the contents be taken from the fasting stomach or after a meal. In cases containing no free HCl the bacteria may be fairly numerous in the fasting contents, even in the normal stomach, or in conditions where neither stasis nor cancer exists. In conditions of stasis where no free HCl is present, they are very numerous, forming a marked contrast to the picture found in any condition where no stasis is present, barring only the presence of active suppuration in the stomach; and a diagnosis of stasis with diminished hydrochloric acid can often be made in a given case by this finding alone. As such a combination is more commonly an associate of cancer than of any other condition, the finding of numerous bacteria in a given case may serve as one suggestion toward the diagnosis of cancer.

Yeast fungi are present in the normal stomach contents.[22] Their number, however, is small even in the fasting contents, and they do not appear as actively budding. In conditions of stasis, however, particularly in stasis contents containing plenty of free HCl, large numbers of actively budding yeast fungi often are present in marked contrast with normal conditions, or conditions of stasis contents without free HCl (*vide* results of my study of the vital content of one hundred and eighty fasting contents, in article on "Gastrectasis," *Boston Medical and Surgical Journal*, Vol. CLII).

A diagnosis of stasis with free HCl often can be made by this finding alone, such a combination being more common in cases where the stasis is due to ulcer or simple dilatation, than in malignant conditions.

The finding of sarcinæ[4] in numbers in the contents is, as

[22] Strauss, *Zeit. f. klin. Med.*, Vol. XXVII, p. 70.

[4] Oppler, *München Med. Woch.*, 1894, No. 29.

already stated, a sign of stasis, and as such is useful in connection with the further diagnosis of cancer or ulcer. As a rule, this organism, going with stasis with a plentiful supply of HCl, is associated with conditions of so-called benign stenosis, ulcer, or simple dilatation, as contrasted with cancer. I have found them, however, as well as free HCl in cancer stenosis. (See Cases IV, XXXVII.)

The finding of the large bacillus known as the Oppler-Boas bacillus in the contents is not, in my experience, distinctive. I have found it in several fasting contents in which no stasis or cancer existed. When present in large numbers, it has the same significance that a finding of large numbers of any bacteria has, in that it shows stasis with fermentation (*vide* Oppler, "Zu Kenntniss d. Mageninhalte bei Carcinoma Ventriculi," *Deutsch. Med. Wochenschrift*, 1895, No. 5).

The study of the size and location of the stomach by the special clinical method of inflation of the organ with air has an important bearing upon the diagnosis of cancer or ulcer, in that we are enabled through it to rule in, or to rule out, the existence of dilatation or ptosis of the stomach, in considering the differential diagnosis of the case.

The mere existence of a large stomach or of ptosis has, in my experience, no great significance, unless it have associated with it evidence that the motor function of the organ is disturbed, *i.e.* the presence of stasis. If stasis is present, however, the findings in regard to the size or location of the organ at once assume importance; for we then encounter the question whether the stasis may be accounted for by simple atonic dilatation or by ptosis, or whether its cause must be sought in cancer or ulcer, or some other pyloric obstruction. If, therefore, we have stasis in a case and an absence of dilatation or ptosis, the indications are practically absolute in favor of cancer or ulcer at the pylorus, or of the rare condition of obstruction from other cause, as adhesions. If in stasis we find marked dilatation or ptosis, we

have to regard these conditions as possible causes of the stasis.[23]

If I were to go by my experience alone, as far as it consists in a study of cases in which the actual abnormality present was determined by pathological examination, and such cases are the only ones upon which it is justifiable to form an opinion, I should conclude that the cause of chronic gastrectasis, as determined by the method of investigation used in this work, is always an obstruction of the pylorus from some cause. For we recall that such a condition was present in all my cases of stasis (see p. 360), both of those with stomachs of normal size, and those with greatly dilated stomachs. That is, my results would lead me to expect the existence of an old cicatrix of ulcer in the majority of cases of dilatation of the stomach of long standing, which as far as clinical evidence goes are often classed as cases of atonic dilatation.

It is, however, an undoubted fact that conditions of stasis due to simple dilatation and atony, or due to ptosis of the stomach without any obstruction of the pylorus, past or present, do exist. And it is quite possible that dilatation or ptosis may cause a twelve hours' stasis, such as was present in my cases. So that we must consider this possibility in chronic stasis where dilatation or ptosis are associates; remembering, however, that stasis from this cause, as compared with obstruction, is rare. In fact, the results of my pathological findings have led me to make the clinical diagnosis of obstruction from ulcer or other causes in the majority of cases, even when no clinical evidence of ulcer existed, simply on the statistical chances.

This completes my review of the special methods of clini-

[23] Hypertrophy of the muscular wall of the stomach is common in cases of stenosis. We do not therefore in these cases get the same proportionate dilatation as with atony. Also the propulsive power of the stomach is greater in stenosis. Extreme dilatations are not, however, uncommon in stenosis.

cal examination, and of the findings by these methods, which in my experience have proven important aids to the facts of the history and regular physical examination, in the consideration of the diagnosis of cancer or ulcer of the stomach.

Chapter III. — Record of Investigation by the Clinical Methods given in this Review of Thirty-seven Cases of Stomach Disorder which came to Operation or Post-mortem Examination

In this review, so far, I have given an outline of the useful methods of clinical examination specially designed for the study of disorders of the stomach, and of the value of the several findings obtained by the use of these methods, in connection with the diagnosis of that class of chronic stomach disorders which are or may be amenable to surgical treatment. The real value of the findings and of the methods appears, however, not so much in the statistical record of the individual findings, since few of them are absolutely diagnostic of or constant in any one particular condition, as in the aid to diagnosis which they provide when the evidence of all together is considered in connection with any particular case. I wish to offer such a demonstration by reporting the records of a series of my cases of stomach disease which have come to operation or post-mortem examination. This series, in providing the actual pathological finding in each case, offers a set of scientific experiments in regard to the indications of the various clinical findings or combinations of findings and to the actual capacity of clinical diagnosis of stomach disorders, which can be obtained by thorough investigation of the cases, along the lines indicated in this review. And I present their records, both as a collection of data on the subjects of cancer and ulcer of the stomach, and as a demonstration of the use and usefulness of these special methods, and of a thorough method of investigation as a routine practice in clinical work.

As a preface to the report, I will summarize the method of clinical procedure used in the collection of the findings, and the methods of reasoning employed in deducing the clinical diagnosis from these findings in the individual cases.

Each stomach patient who presented himself at the clinic was put through the following routine, eliminating, of course, conditions of acute hemorrhage: —

The first point investigated in each patient was, whether or not his case showed evidences of the existence of any of the pathological conditions for the relief or cure of which surgery is a therapeutic method; namely, one of the two diseases, cancer or ulcer of the stomach, or gastrectasis or insufficient drainage, from any cause, such as would justify an absolute or probable diagnosis of any of these conditions.

If evidence of such conditions was found, and the case appeared one which demanded or was likely to benefit from operation, operation was prescribed. If definite evidence of the existence of any such conditions were lacking, the case was further investigated by the measures of the internist.

The study of each case was conducted as follows: —

After the record of the history of the case and of the physical examination had been made, one of two courses was adopted, depending upon the circumstances.

1. If the record suggested strongly the presence of stasis, or if a tumor was present, or if the patient came from a distance, the contents of the stomach were obtained by the tube at once, — regardless of the time elapsed since a meal. By this means it was often possible, through the finding of evidence of stasis, such evidence as sarcinæ, or food remnants clearly those of food taken on a previous day, or positive yeast fermentation, or through the finding of blood (excluding meat), to expedite diagnosis without the delay incident upon obtaining the fasting contents. Thus I could

place the case immediately in the hospital wards, where an analysis of the fasting contents was made at a later date for purposes of confirmation or record.

2. If such immediate action was not indicated, or if the results of the above methods did not give positive indications of a definite *surgical* lesion, the patient was instructed to eat regular meals, excluding all meat and blood-containing substance from the diet, for forty-eight hours, and then to return, after a twelve hours' fast. Then the *contents of the fasting stomach* were obtained by the tube.

After the expression of contents, the stomach was inflated with air, and its size and location and the presence of a tumor investigated.

The contents of the fasting stomach were examined with reference to the following characteristics: —

(*a*) The presence of an abnormal food residue, recognizable by macroscopic examination or by study with the microscope.

(*b*) The presence of sarcinæ in the sediment.

(*c*) The presence of lactic acid.

(*d*) The presence or absence of free hydrochloric acid.

(*e*) The presence of blood (inspection, or guaiac test).

(*f*) The sediment was also examined in regard to the number of low organisms, the presence of pus, and of fragments of cellular growths.

(*g*) After the above examinations the contents were subjected to the yeast fermentation test. (This test is necessary only when other evidences of stasis are lacking.)

After the expression and examination of the fasting contents, the patient was given an Ewald test meal, when the contents were expressed and examined qualitatively and quantitatively for free HCl. This step is necessary only in cases in which diagnosis has not already been determined by the previous examinations, or when no free HCl is present in the fasting contents. Its chief use is for discrimination in regard to the presence or absence of free HCl and the

estimation of the quantity, — points which cannot be determined by the examination of the fasting contents. (See Cases III and XXIV.) (Tabora, *Deutsch. Med. Woch.*, 1905, p. 576.)

The clinical procedures should be carried out to the point of diagnosis, or, failing a final diagnosis to their limit, in every case which comes to the clinic. If, finally, stasis is excluded, and the question of cancer or ulcer is left not proven, further investigation as to the character of the disorder present may be carried on under medical observation, whether for a hyper-secretion, an atrophy of the stomach, or nervous dyspepsia.

The general method of reasoning employed in arriving at a clinical diagnosis from the physical findings, particularly those findings discovered by the use of these special methods, was the following: —

1. The presence of stasis, as evidenced by food residue in the fasting contents, or of sarcinæ in any contents, was taken to indicate the existence of obstruction of the pylorus from cancer or ulcer or adhesions, or other cause, or possibly the existence of simple atonic dilatation or ptosis without actual obstruction.

2. The presence of stasis or stagnation as evidenced by the presence of lactic acid or yeast fermentation in the fasting contents, *no food residue being present*, was taken to indicate one of the above causes of stasis, obstruction of the pylorus or atony, or as an alternative a neoplasm situated anywhere on the stomach wall. (See Note 18.)

In differentiating these various conditions which may exist as underlying causes of stasis, the following observations were of value: —

The absence of ptosis or of marked dilatation, shown by the inflation test, tended to rule out atonic dilatation as the cause of stasis, and to fix the diagnosis as ulcer or cancer or adhesions at the pylorus. (See Cases II, XII.) The presence of marked ptosis or dilatation gave these simple causes

— such as atonic dilatation — consideration as possible causes of the stasis, though, as a rule, even when marked dilatation was present, a diagnosis of ulcer or cancer as its cause was made, from the combined symptom picture. (See Cases XV, XIX.)

Blood, in addition to stasis, made very definite the indication of cancer or ulcer as the cause of the stasis. The absence of free HCl, after a test meal, or the presence of lactic acid, in combination with stasis, were strongly suggestive of cancer as the cause of the stasis, as against ulcer or other cause. (See Cases V, XII, contrasted with Cases II, IX.) The presence of free HCl with stasis, though more common with ulcer than with cancer, is so common in cancer that it was given but secondary weight in differential diagnosis. (See Cases IV, V, XXXVII.)

If stasis was not demonstrable in a case, obstruction of the pylorus or dilatation or ptosis of sufficient degree functionally to cause insufficient drainage were ruled out; and the diagnosis was reduced to a question of ulcer or cancer, located elsewhere than in the pylorus, or to some one of the affections of the stomach not necessitating surgical interference, — that is, to some one of the various "medical" affections of the organ.

As to the special diagnosis of cancer or ulcer, under these latter conditions, the following findings were regarded as significant: —

1. The presence of blood in the stomach contents — fresh blood or blood found by a chemical test (outside causes of this phenomenon and an acute condition being excluded) — was taken as strongly suggesting the existence of cancer or ulcer. (See Cases I, III, XVI.)

2. With the finding of any symptom suggesting cancer or ulcer, the absence of free HCl, both in the fasting contents and after the Ewald meal, was taken to favor cancer; while the presence of free HCl, especially of an excessive quantity of free HCl, was regarded (here

where no stasis was present) as favoring ulcer (*vide* page 371).

In the absence of any of the above significant findings or combinations of findings, the diagnosis of cancer or ulcer, or other affection of the stomach demanding surgical interference, was thought to be not proven, barring, of course, cases with a history of hæmatemesis, or with a showing of stomach symptoms associated with cachexia.

In my investigation one hundred and sixty cases of stomach disorder were examined by the above method. The records of those of the cases in which a pathological examination was obtained, thirty-seven in number, are given in the chart. In this chart I give, as of direct value in diagnosis, in the record in each case, first, the clinical findings obtained by the use of the special methods of physical examination reviewed, — such as the presence of food residue, blood, the presence of dilatation by inflation; also certain facts of the history, as age, or duration of symptoms, or of the regular physical examination, as the presence of tumor or cachexia. Then I give the clinical diagnosis as deduced from these findings, and finally I report the anatomical or pathological examination, at operation or post mortem.

A summary of these records is as follows: —

Total number of cases of stomach disorder investigated, one hundred and sixty.

Number in which anatomical or pathological diagnosis was obtained, thirty-seven.

In these thirty-seven cases the corresponding records of the clinical diagnosis made previous to operation and of the anatomical or pathological diagnosis made at operation or post mortem are as follows: —

Eighteen cases, clinical diagnosis, cancer; pathological diagnosis, cancer in all.

Twelve cases, clinical diagnosis, ulcer; pathological diagnosis, ulcer in eleven cases, cancer in one case.

One case, clinical diagnosis, gastrectasis; probable cause,

cancer or ulcer. In this case the pathological diagnosis was adhesions about pylorus from gall-bladder.

One case, cause of symptoms unknown. Stomach contents normal. In this case the pathological findings were, chronic appendicitis, and large mesenteric glands. Stomach, no lesion.

Three cases, diagnosis, neurosis; no cause for operation. Pathological finding in all, no lesion of stomach.

One case of hypoacidity; operated upon for ventral hernia and explored for possible cancer. Contents normal save for hypoacidity. Pathological finding, stomach intact.

That is to say, in thirty-one cases of stomach disorder in which the clinical findings pointed to the existence of cancer or ulcer of the stomach, and in which such a diagnosis was definitely made from the clinical findings, one of the two was found in all, and the diagnosis of the type of lesion was correct in all save one case. In three cases in which no cause for operation was found clinically, no cause was found at the operation. In two cases in which the clinical findings failed to show definite evidences of an organic lesion, but which were operated upon for other reasons, no lesions of the stomach were found.

The accuracy of the evidence gained by these clinical methods of examination is still more marked if we study the testimony of the records in regard to ascertaining the location of the diseased conditions. These records show: —

Nine cases clinical diagnosis of cancer at the pylorus; the pathological finding in these nine cases, cancer at the pylorus in all.

Nine cases clinical diagnosis of ulcer involving or occluding pylorus; the pathological diagnosis in these cases: ulcer at pylorus, eight cases; cancer at pylorus, one case.

The conclusion that can be drawn from work, in regard to the accuracy of diagnosis which can be achieved through the practice of a thorough method of clinical examination in all cases of stomach disorder, is certainly a definite one.

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Case. Age. Duration of Symptoms.	Number of Examinations.	Quantity of Contents in Fasting Stomach.	Food Residue in Fasting Contents (Macroscopic).	Fermentation Tests in Fasting Contents. 1. Sarcinæ 2. Lactic Acid 3. Yeast Ferment Test	Blood in Contents Fresh Blood or by Guaiac Test.	Free Hydrochloric Acid in Fasting Contents	Free Hydrochloric Acid after Ewald Test Meal.	Points of Significance in Physical Examination and History.	Clinical Diagnosis made from Foregoing Findings.	Pathological Diagnosis made from Findings at Operation or Post-mortem Examination.
I	1	180 cc.	None	None	+ Guaiac	0.01%	0.03%	Extreme tenderness in left epigastrium. Emaciation.	Cancer of stomach in anterior wall.	Cancer of anterior wall. Perforation with adhesions. Ulceration of surface.
50 years	2	60 cc.	0	0	0	0.03%	0.18%			
2 years	3	30 cc.	0	0	+ Guaiac	0	0.09%			
II	1	800 cc.	Food	Lactic acid	0	0	0	No signs save loss of weight, and pain.	Cancer involving pylorus.	Cancer at pylorus and over one-third stomach wall.
40 years										
4 months	2	1000 cc.	Food	Lactic acid	0	0	0			
III	1	50 cc.	None	None	+ Guaiac	0	0.003%	No signs save loss of weight, and pain.	Cancer of stomach.	Cancer in antrum very small, slight ulceration on growth.
48 years										
1 year	2	20 cc.	0	0	+ Guaiac	0	0.007%			
IV	1	1000 cc.	Food	Sarcinæ. Yeast ferment test	0	0.11%	0.15%	Dilatation of stomach. Question of tumor in left hypochondrium, doubtful.	Cancer of pylorus (from age of patient) on former ulcer.	Cancer at pylorus.
68 years										
3 years	2	600 cc.	Food	*Ibid.*	0	0.13%				
V	1	100 cc.	Food	Sarcinæ. Yeast ferment test	+ Guaiac	0.19%	0.16%	Some dilatation.	Ulcer at pylorus.	Ulcer at pylorus.
30 years										
2 years	2	120 cc.	Food	*Ibid.*	+ Fresh	0.14%				

VI 46 years 2 years	1	450 cc.	Food	Sarcinæ. Yeast ferment test	+ Guaiac	0.13%	0.18%	Dilatation. Loss of weight.	Ulcer at pylorus.	Ulcer at pylorus.
VII 64 years 2 years	1	500 cc.	Food	Lactic acid	0	0	0	Tumor.	Cancer at pylorus.	Cancer at pylorus.
VIII 34 years 7 months	1	200 cc.	Food	Yeast ferment test	+ Fresh	0	0.11%	Anæmia. History of hæmotemesis.	Ulcer at pylorus.	Cancer at pylorus.
	2	160 cc.	Food	*Ibid.*	*Ibid.*	0.004%	0.12%			
IX	1	400 cc.	Food	Lactic acid	0	0	0	Dilatation. Emaciation.	Cancer at pylorus.	Cancer at pylorus.
	2	1000 cc.	Food	Yeast ferment test. Lactic acid	0	0	0			
X 34 years 3 years	1	200 cc.	None	None	0	0.28%	0.21%	No signs save distress.	Ulcer of stomach, with hypersecretion.	Ulcer of anterior wall. Pylorus patent.
	2	400 cc.	0	0	+ Guaiac	0.22%	0.25%			
XI 78 years 3 months	1	40 cc.	None	None	0	0	0	Constant vomiting. Emaciation.	Cancer of stomach.	Cancer of wall (Schirrus).
XII 29 years 4 months	1	25 cc.	Food	None	0	0.1%	0.13%	No signs save dyspepsia and loss of weight.	Ulcer of stomach.	Ulcer in antrum. Old scar causing pucker of membrane to obtrude before pylorus. Pylorus itself patent.
	2	20 cc.	Food	0	0	0.11%				

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Case. Age. Duration of Symptoms.	Number of Examinations.	Quantity of Contents in Fasting Stomach.	Food Residue in Fasting Contents (Macroscopic).	Fermentation Tests in Fasting Contents. 1. Sarcinæ 2. Lactic Acid 3. Yeast Ferment Test	Blood in Contents Fresh Blood or by Guaiac Test.	Free Hydrochloric Acid in Fasting Contents	Free Hydrochloric Acid after Ewald Test Meal.	Points of Significance in Physical Examination and History.	Clinical Diagnosis made from Foregoing Findings.	Pathological Diagnosis made from Findings at Operation or Post-mortem Examination.
XIII 50 years 1 year	1	30 cc.	None	None	+ Guaiac	0	0	Emaciation. Sediment of contents consists of pure pus.	Cancer of stomach.	Cancer of lesser curvature.
XIV 40 years 1 year	1	180 cc.	Microscopic only	Yeast ferment test	0	0.03%	0.14%	Slight dilatation.	Gastrectasis. Probably cancer or ulcer near pylorus.	Mass of adhesions constricting pylorus.
	2	60 cc.	*Ibid.*	*Ibid.*	0	0.19%	0.12%			
XV 38 years 5 years	1	150 cc.	Food	Yeast ferment test	0	0.08%	0.06%	Much dilatation.	Ulcer of pylorus (old ulcer).	Large cicatrix of ulcer at pylorus.
XVI 60 years 3 months	1	50 cc.	None	None	+ Guaiac	0	0	No signs save loss of weight, and dyspepsia.	Cancer of stomach.	Cancer of lesser curvature.
XVII 24 years 1 year	1	20 cc.	None	None	0	0.12%	0.11%	Vomiting. Neurotic type of person.	Neurosis. No objective evidence of stomach trouble.	Stomach intact (opened). Operation against advice.

XVIII 30 years 4 months	1	12 cc.	None	None	+ Guaiac	0	0	Tumor in left epigastrium. Emaciation.	Cancer at pylorus.	Cancer at pylorus.
	2	20 cc.	0	0	+ Fresh	0	0			
XIX	1	400 cc.	Food	Yeast ferment test	0	0.04%	0.11%	Dilatation.	Ulcer at pylorus.	Ulcer at pylorus.
XX	1	75 cc.	None	None	+ Fresh	0	0	Tumor.	Cancer of stomach.	Cancer of lesser curvature and anterior wall.
XXI 55 years 3 months	1	400 cc.	Food	Lactic acid	+ Guaiac	0	0	Tumor in left epigastrium.	Cancer at pylorus.	Cancer at pylorus.
XXII 56 years 2 months	1	500 cc.	None	None	0	0.21%	0.24%	No signs save pain and vomiting.	Ulcer of stomach. Hypersecretion. No stasis.	Ulcer of anterior wall.
	2	800 cc.	None	0	+ Fresh clots	0.11%				
XXIII 66 years 1 year	1	100 cc.	Food	Lactic acid	+ Guaiac	0	0	Tumor in left epigastrium. Dilatation.	Cancer at pylorus.	Cancer at pylorus.
XXIV 38 years 2 years	1	50 cc.	None	None	None	0	0.06%	No signs save constant pain in abdomen and loss of weight.	No direct evidence of stomach trouble. Exploratory.	Stomach intact (opened). Chronic appendix and large mesenteric glands.
	2	10 cc.	0	0	0	0	0.11%			
	3	25 cc.	0	0	0	0.07%				
XXV 52 years 16 months	1	1000 cc.	Food	Lactic acid	+ Guaiac	0	0	Tumor in left epigastrium. Emaciation.	Cancer at pylorus.	Cancer at pylorus.
	2	900 cc.	Food	*Ibid.*	*Ibid.*	0	0			

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Case. Age. Duration of Symptoms.	Number of Examinations.	Quantity of Contents in Fasting Stomach.	Food Residue in Fasting Contents (Macroscopic).	Fermentation Tests in Fasting Contents. 1. Sarcinæ 2. Lactic Acid 3. Yeast Ferment Test	Blood in Contents Fresh Blood or by Guaiac Test.	Free Hydrochloric Acid in Fasting Contents	Free Hydrochloric Acid after Ewald Test Meal.	Points of Significance in Physical Examination and History.	Clinical Diagnosis made from Foregoing Findings.	Pathological Diagnosis made from Findings at Operation or Post-mortem Examination.
XXVI 30 years 6 years	1	400 cc.	None	None	0	0.28%	0.21%	No signs except spells of pain. History of vomiting blood five years before.	Ulcer of stomach.	Ulcer of anterior wall. Perforation and adhesions to liver.
	2	100 cc.	0	0	+ Guaiac	0.20%				
XXVII 64 years 1 year	1	15 cc.	None	None	0	0	0.002%	Dyspepsia and anæmia.	No direct evidence of stomach disease. Ventral hernia.	Operation for hernia. Stomach found intact.
XXVIII 42 years 1 year	1	30 cc.	None	None	+ Clots	0	0	Tumor above navel. Erosions in contents.	Cancer of stomach.	Cancer of anterior wall.
XXIX 27 years 18 months	1	300 cc.	Food	Sarcinæ. 1 tube of gas in 36° Yeast ferment test	None	0.07%	0.13%	Tumor felt in left epigastrium.	Ulcer at pylorus.	Ulcer at pylorus, with adhesions.
XXX 64 years 18 months	1	200 cc.	Food	Lactic acid. Yeast ferment test	+ Coffee grounds (Guaiac)	0	0	Tumor in left side.	Cancer at pylorus.	Cancer at pylorus.

XXXI 40 years 16 months	1	600 cc.	Food	Sarcinæ. 1 tube of gas in 24° Yeast ferment test	None	0.11%	0.16%	Slight dilatation.	Ulcer at pylorus.	Ulcer at pylorus.
XXXII 50 years 2 years	1	30 cc.	0	None	+ Clots	0	0	Tumor in left side. Pus in sediment.	Cancer of stomach.	Cancer of lesser curvature. Ulceration.
	2	15 cc.	0	None	+ Fresh	0	0			
XXXIII 36 years 1 year	1	600 cc.	Food	1 tube of gas in 24° Yeast ferment test	+ Guaiac	0.24%	0.26%	Dilatation.	Ulcer at pylorus.	Ulcer at pylorus.
XXXIV 60 years 5 years	1	40 cc.	None	None	None	0	0.04%	Dyspepsia for years.	No direct evidence of stomach disease.	Operation against advice. Stomach intact (opened).
XXXV 24 years 1 year	1	20 cc.	None	None	None	0.19%	0.21%	History of dyspepsia and frequent vomiting.	No direct evidence of stomach disease.	Operation against advice. Stomach intact (opened).
XXXVI 34 years 6 months	1	60 cc.	None	None	+ Guaiac	0	0	Doubtful tumor in epigastrium.	Cancer of stomach.	Cancer of anterior wall.
XXXVII 62 years 4 months	1	800 cc.	Food	Sarcinæ	+ Guaiac	0.11%	0.07%	Tumor in left side. Emaciation.	Cancer at pylorus.	Cancer at pylorus.

Although the number of observations in this series is limited, the record is so emphatic that it encourages us to believe that if such a method of study is applied as a routine in all stomach cases, much more accurate results as regards diagnosis will be obtained than at present are the rule. As a result, we shall on the one hand bring to operation at an earlier date than at present those causes in which operation is serviceable, and on the other hand we shall have fewer cases operated upon unnecessarily, or upon insufficient evidence.

I have in this report omitted the histories and symptoms of the cases, for the reason that the investigation was designed to determine not the full roster of the signs and symptoms of cancer and ulcer, but simply the value of the findings by special or expert methods of stomach investigation.

The value of obtaining facts by these special methods, in addition to those of the history and physical examination, is demonstrated in a general way by the great accuracy of these records of diagnosis. Of course we cannot say what the results in the same cases would have been had the special findings not been at hand, and had the history and physical examination been the only data for diagnosis. It is safe to say, however, that our conclusions would have been less correct, and that, in many instances, guesswork would have replaced scientific deduction.

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